HIGH SPEEDS
Demand GOOD TRACK
100 PER CENT STANDARD
RAJO COMPROMISE
CONTINUOUS AND
ARMORED INSULATED
RAIL JOINTS
Rock Island

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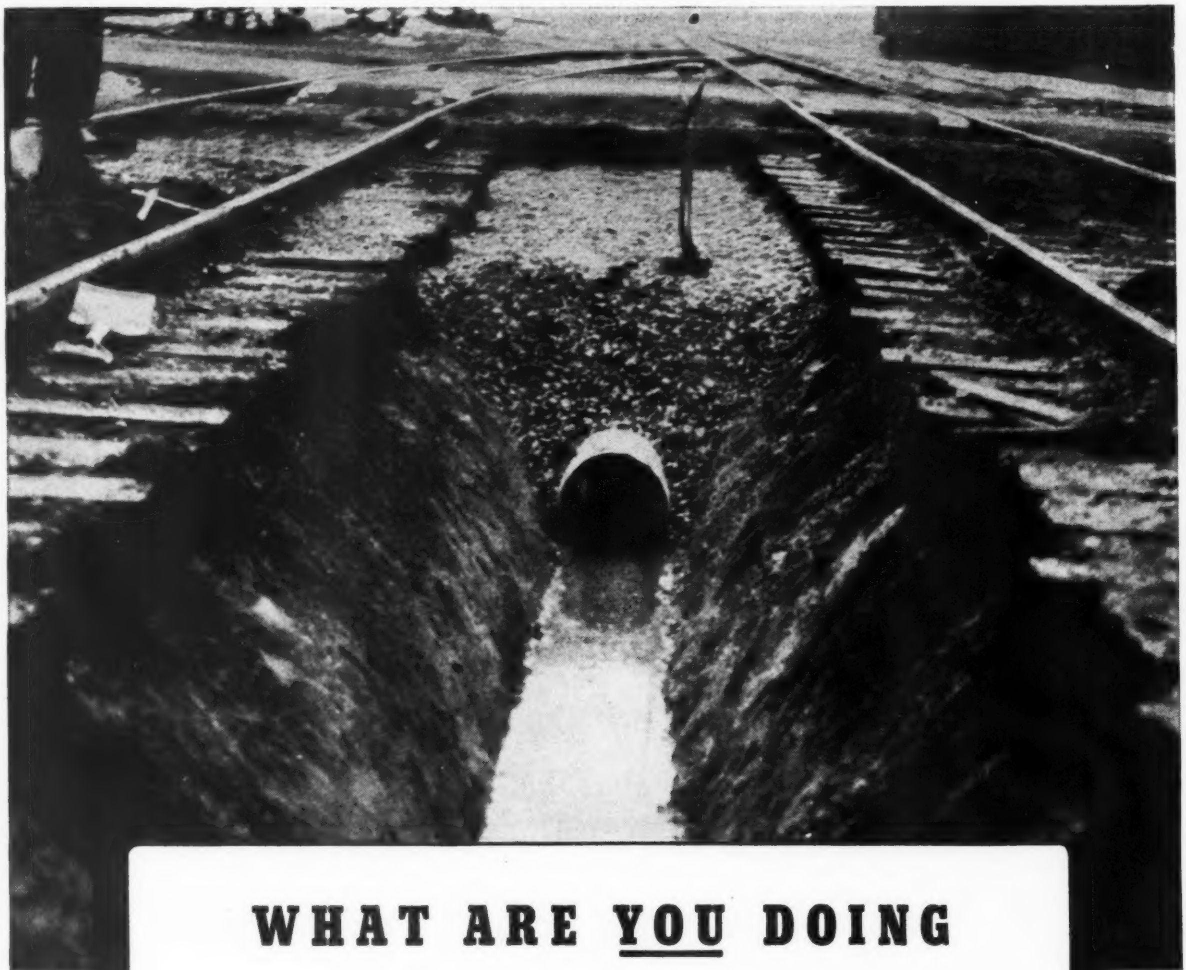
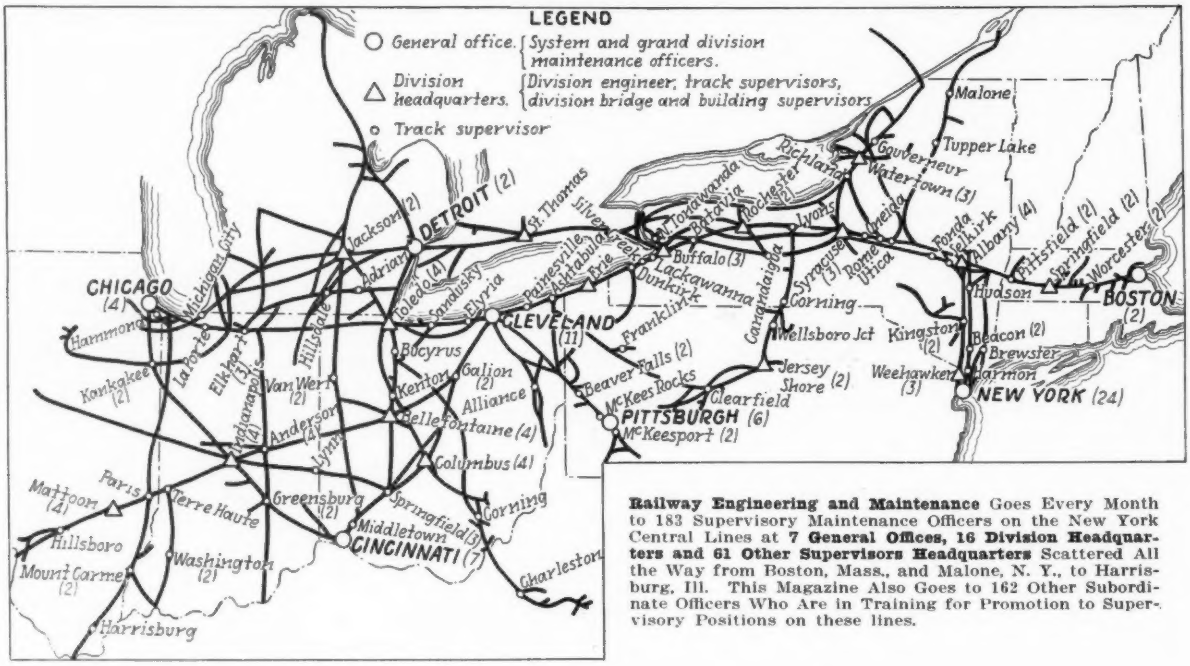


TO RAILWAY SUPPLY MANUFACTURERS



Railway Engineering and Maintenance Goes Every Month to 183 Supervisory Maintenance Officers on the New York Central Lines at **7 General Offices, 16 Division Headquarters and 61 Other Supervisors Headquarters** Scattered All the Way from Boston, Mass., and Malone, N. Y., to Harrisburg, Ill. This Magazine Also Goes to 162 Other Subordinate Officers Who Are in Training for Promotion to Supervisory Positions on these lines.

"A Swell Idea"

"Bill, how long has it been since you saw John ————, supervisor on the New York Central at ————?", asked the sales manager of a railway supply company.

"I haven't seen him for a couple of years. Why?", replied the district sales representative.

"Oh, I met him on a train while on my vacation last week and when I asked him if he was using our equipment, he said he'd never heard of it. And what's more, he was using our competitor's."

"Well, I can't get around to see everybody, even on the main line, since you've cut our staff and increased my territory. Why, there are 84 *different* maintenance headquarters on the New York Central Lines alone and it would take me three months to cover all these points on the one road—and even then I'd miss half of the men, for they would be out on the line."

"Well, how did our competitor get its equipment on this man's territory? They must be a lot faster workers than we are."

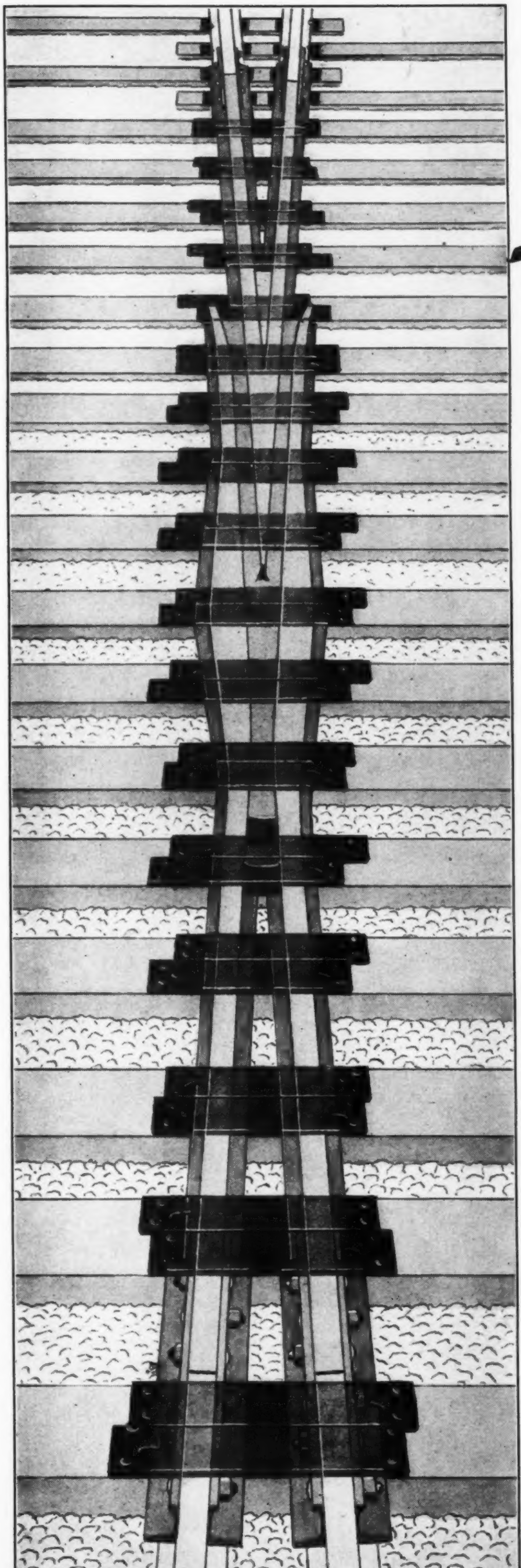
"No boss, that isn't so. But, I'll tell you one thing—they back up their salesmen with an advertisement in every issue of Railway Engineering and Maintenance. These maintenance officers all read that magazine and that advertisement keeps their product before them between calls. And it reaches the men we miss when we do call, so they don't forget it."

"That's a swell idea. What's it cost?"

"Boss, they tell me it costs less than three cents per contact per month."

"That's not much—and it'll show these railway men that we're still in business until we can get around to see them."

RAILWAY ENGINEERING AND MAINTENANCE IS READ BY MAINTENANCE OFFICERS OF ALL RANKS



Take 'em from stock

FIT UP ANY FROG

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Better than individual tie plates . . .

if you use individual tie plates with frogs, you'll find Bethlehem Twin Frog Plates reduce storehouse and field inventories. A pair of Twin Frog Plates will fit any tie under any frog. While you may wish to stock two or more lengths of these plates for economy's sake, still the advantage of reduced stock is apparent.

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Twin Frog Plates do not hinder tamping of the ties. They minimize warping or bending under heavy loads. And there is nothing to loosen or rattle—hooks are forged integral with the plate.

Twin Frog Plates are now extensively used by many Class I railroads. Experience has proved that the hook, forged from the plate itself, has greater holding power than a spike; that the ample bearing surface protects ties; that reduced inventories and decreased field labor make them the economical tie plate for frogs.

BETHLEHEM STEEL COMPANY

No. 117 of a series

Railway
Engineering and Maintenance
SIMMONS-BOARDMAN PUBLISHING CORPORATION

105 WEST ADAMS ST.
CHICAGO, ILL.

Subject: The Railway Supply Industry

September 1, 1938

Dear Reader:

"I have just been reading your timely letter in the August issue in which you referred to the importance of railway employees informing the public regarding the nature and value of the service rendered by the railways. I concur heartily in the thought expressed in your letter but, as a railway supply man, I feel that it is just as important that the public have an adequate appreciation of the value of the contribution that the railway supply companies have made to comfort and safety of travel."

This was the gist of a letter that I received a few days ago from a man of broad experience and acquaintance in the railway supply field. His point is well taken.

I am sure that you agree with me in the belief that credit is due railway supply manufacturers for a large part of the progress that the railways have made. Without their help in perfecting and developing nearly all of the materials the railways use today and in their bringing these materials to their attention time after time until they were accepted, the railways would not have progressed as they have. To them goes the credit, jointly with the railways, for the progress that is being made in public service.

It is fitting that the nature and extent of this contribution of the railway supply manufacturers is being recognized and that they are being given a place in the Transportation Building at the New York World's Fair. Here these manufacturers are joining with the railways in an educational exhibit that is designed to stimulate recognition of the basic contribution that the railway and railway supply industries are making to the safety, comfort and convenience of railway travel. This is a most commendable movement. We are happy to see it.

Yours sincerely,

Elmer T. Howson
Editor

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Railway Engineering and Maintenance

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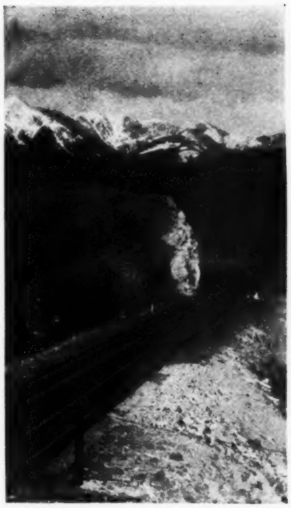

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Railway Engineering and Maintenance

Highways

Who is Paying the Bill?

THE most outstanding development in transportation facilities during the last quarter century has been the construction of our vast system of improved highways. These highways have been built by public agencies and with public funds. On them have developed a variety of transportation services for freight and passenger traffic that have become a serious competitor of the railways.

The railways have suffered inroads on their earnings from this competition because of its lack of knowledge of its own costs and its freedom from regulation over rates, service, and working conditions of employees comparable with the restrictions placed on the railways. The railways have suffered particularly because of the public subsidies given these buses and trucks by opening the highways to them with charges that are only a fraction of the figures necessary to make good the wear and tear caused by these vehicles.

Public Subsidies—Illinois

Motor transport operators have long challenged the railways' contention that these operations are made possible only by public subsidies and have presented many figures of the amounts paid by motor vehicles in fees and taxes of various forms. These figures have, however, been designed to be more confusing than informative. They have failed, for illustration, to separate the payments of pleasure vehicles from those made by commercial trucks and buses, although it is the latter to which the railways are directing attention.

That the railways' contention has not been without merit is now made evident by studies that are being made by disinterested public authorities. Confronted by the destruction of thousands of miles of hard surface highways years before their anticipated life had been reached, these highway authorities are being forced to investigate what is happening for it is jeopardizing their entire program of financing. Their findings are highly interesting to railway men and to the public which is paying the bill.

In Illinois, for illustration, it was estimated originally that that state's network of 10,000 miles of improved highways could be maintained in good repair at an annual cost of $2,000,000, or $200 a mile. Experience shows, however, that this figure is much too low, for Illinois highway officers now find that the average cost of maintaining these roads for the period from 1930 to 1938 has been $353 a mile, while it has been necessary to spend as much as $1,000 a mile on some sections carrying heavy truck traffic.

Furthermore, it has been found that 75 per cent of the trucks registered in Illinois are of less than five tons weight, a size used mostly by farmers and other individuals for their own operations, while less than 17 per cent of the trucks registered in that state weigh six tons or more. It is found that, after giving full effect to all payments made by the operators of these trucks for license fees, gasoline taxes, etc., these trucks weighing five tons and over are failing to pay their way by $13,000,000 a year in the one state, while if only those trucks weighing six tons or more are considered, the deficit is $10,000,000. This deficit is being defrayed by the operators of passenger automobiles and light trucks, and by the taxpayers at large. It constitutes a direct subsidy to these trucks.

Situation in Missouri

Nor is Illinois alone in this experience. Missouri is another state in which the highway authorities have become alarmed over the destruction of their roads. Here studies show that whereas trucks weighing more than nine tons should pay $1321.87 in taxes annually to compensate the state fully for wear and tear, they actually pay $706.08, leaving a deficit of $615.79 per truck per year to be borne by the taxpayer. Likewise, the deficit for an eight-ton truck is placed at $657.50 per year; for a seven-ton truck at $588.97; and for a six-ton truck at $497.92. As in Illinois, it was shown that the larger the truck the greater is the subsidy that it is receiving. And it is these larger trucks that are being operated in direct competition with the railways.

Unfair Competition

It is in large measure through subsidies such as this that trucks and buses have been able to make such inroads in railway traffic, creating a competition that is as unfair as it is uneconomic, but there is still another sufferer from this situation—the taxpayer. He sees the vast expenditures that he has made for the construction and maintenance of modern highways being destroyed by

those who are using his investment for their private gain.

In our last issue we referred to the report of the Inland Waterways Corporation for 1937 and especially to its reported net income of $253,935 and showed that, when consideration is given to all costs, including taxes, to which the railways and other privately-owned agencies of transportation are subjected, this income becomes a deficit of very real proportions. Who, we then asked, is paying this bill? We now ask the same question with regard to the highways. The answer is evident. It is in part the railways, their stockholders and those individuals and industries who patronize the railways; it is in part the general public which is paying into the treasury taxes to defray these deficits.

It is time that these transportation agencies on the highways and on the waterways be required to pay their full way on a basis comparable with the railways. Until this is done, both the railways and the public will continue to suffer. Railway employees can do much to bring about a public understanding of these facts, that will lead to their correction.

Track Levels

Have They the Requisite Sensitiveness?

PRACTICES in track maintenance, being in large part the result of evolution, usually change slowly, even in the face of new developments in materials, equipment and operating methods. Occasionally, however, some radical development takes place which requires a complete reorientation with respect to practices of long standing. The most recent of these is the marked increase in passenger-train speeds which began less than five years ago and which has now extended to include most of the important passenger-carrying lines of the country.

While these increased speeds have brought no fundamental changes in maintenance practices, they have necessitated an almost complete change in the viewpoint of maintenance officers toward refinements in track maintenance, for track that rode satisfactorily at the former speeds often causes discomfort when the speed reaches 90 to 100 miles an hour, line and surface being the most important elements, except curves, in causing discomfort to passengers.

In searching for means whereby refinements can be obtained, the track level has come under scrutiny, and the conviction is growing in many quarters that the level in common use lacks the sensitivity that is necessary to permit trackmen to bring the track to the standard of excellence demanded by high-speed train operation. Few will deny that the present track level is sluggish, measured by any reasonable standard. The radius of the bubble tube is short, and when the level is placed across the rail the angular change for small vertical movements of one end is so slight that the bubble does not respond readily. In fact, few of the levels in regular use will detect differences in the elevation of the two rails of 1/8 in. or less, and not a few will require as much as 1/4 in. before the bubble will respond, especially on a hot day when its size is reduced to the minimum.

A longer and more sensitive bubble is needed to insure the better riding qualities of the track that are demanded by present-day speeds, for accurate cross level is an important element in the maintenance of smooth surface. A high degree of accuracy in leveling can be attained if the railways will replace the present type of tube, bent to a relatively short radius, with a tube ground to a longer radius, and containing a longer bubble and end graduations. Such a bubble will be sufficiently sensitive to detect very small differences in level and should enable trackmen to attain much greater refinement in surfacing than has heretofore been possible.

Fire Hose

Keep It in Condition for Use

SAFETY, that is, avoidance of personal injuries and of the conditions that may cause them, is paramount in railway operation and maintenance. The subject of safety lends itself to dramatic presentation, for the human element is so directly involved and the consequences may be so serious that the appeal to self-interest is strong. Another form of disaster that has not always been emphasized as much as it should is the destruction of railway property by fire. Obviously, this subject, being more or less impersonal, does not have the same emotional appeal as safety; yet from the standpoint of property loss it is of the highest importance.

Educational work in fire prevention has, therefore, been carried out more quietly than has been the case in safety campaigns, for which reason some of the fundamental rules of this activity have not seemed so impressive and have not always been enforced as rigidly by local maintenance officers as their importance warrants. Only one of these, keeping fire hose in condition for immediate use, will be mentioned. Fire-protection equipment is provided only for emergencies, and should be known to be in condition for use when the emergency arises. Once a fire has started, no time is available for making repairs or replacing equipment that will not work. The first three or four minutes constitute the critical period for most fires, and if water cannot be turned on within this time the structure may be beyond saving by the time other equipment can be obtained.

To avoid such a contingency, fire hose should be given regular and rigid inspection. If any section is open to suspicion it should be replaced immediately. Investigation should be made to determine whether the hose is being used for purposes other than fire protection and, if so, measures should be taken promptly to stop the practice. Even when rules are specific and supervision is good, employees will sometimes take a section of hose off a rack or reel to wash down shop floors, to sprinkle driveways around freight houses or stations, to flush platforms or wash windows, and for other purposes in no way related to fire protection. Failure to return the hose to its proper place, returning it in damaged condition or returning it undrained is usually incidental to such use.

Inspectors should be alert to determine whether the

hose is being given the care it requires after use and when not in use. Rubber-lined cotton hose is used most widely because it withstands better than linen hose the rough usage it is likely to receive at shops, freight houses, enginehouses, etc. This type should never be folded, but should be wound on reels, and while it should be well drained after use, the lining should never be allowed to dry out completely or it will become brittle and crack. On the other hand, linen hose can be folded without detriment, and must be kept completely dry, in which condition it will last almost indefinitely.

To a busy officer, looking after fire hose sometimes seems to be a small matter compared with others that are pressing for attention, and too often they are inclined to put it off until a more favorable time. Every division, therefore, should include among its employees some one who is charged with responsibility for the condition of fire protection equipment. It may be needed only at rare intervals but when it is the need is very great, and the saving may be many times the cost of constant supervision.

Annual Inspections

Are They to Become a Thing of the Past?

WHAT has become of annual track inspections? Prior to the depression a considerable number of roads considered such inspections an essential part of their year's programs, or at least the highlight consummating their year's efforts. During the last few years this practice has been curtailed or eliminated by all but a few roads, and, in all probability, as the season for such inspections draws near this year, only these few roads are again giving consideration to making any sort of a final field check of the accomplishments of the year.

The answer to the discontinuance of such inspections on most roads is, unquestionably, the expense which they involve, which expense, under the method usually followed of employing a special inspection train, amounts to a considerable figure. On one relatively small eastern road, which carried out annual inspections for 11 consecutive years ending with 1936, the annual expense, including the cost of 1,500 train miles, meals and all incidental expenses, amounted to approximately $2,000. This was in addition to the $1,680 which was distributed in the form of cash prizes to track foremen as awards for excellence in the condition of their respective territories. From this example, it is evident that the cost of annual inspections on larger roads becomes a sizable figure, especially in the light of conditions today, when there is frequent necessity for the enforced curtailment of expenditures for even routine maintenance operations.

One large eastern road which has a long record of annual track inspections, continuous throughout the depression years, eliminated the making of prize awards a number of years ago in order to be able to continue making the inspections. In recent years, those foremen and supervisors whose territories have been adjudged as having been maintained throughout the year to the highest degree of excellence, receive letters of commendation from their superior officers, usually the division engineer in the case of foremen, and the general superintendent in the case of track supervisors. While the discontinuance of the cash awards may have been a disappointment to the men at the time, the new arrangement was quickly accepted and the yearly inspections have continued with little, if any, decrease in interest on the part of the men, or in value from the standpoint of the railroad.

Some roads, which in former years made a big event of their annual inspections, have not seen their way clear to go even this far, the out-of-pocket expense of making the inspection itself being considered inadvisable under the conditions existing. However, in practically all cases the inspections were given up with a full recognition of the loss of certain important advantages to be derived, and with the hope that they could be resumed at an early date. This being the case, it seems surprising, in view of the delay in the return to normal conditions, that no substitute has been developed to recapture the accepted advantages of such inspections, without incurring the sizable expenses which they involved. With a little concerted thought, it does not seem improbable that some form of effective substitute could be devised, even though it might possibly resolve itself into an inspection on a region, district or division basis, rather than on a system basis, and employ motor cars or regularly scheduled trains, instead of special trains.

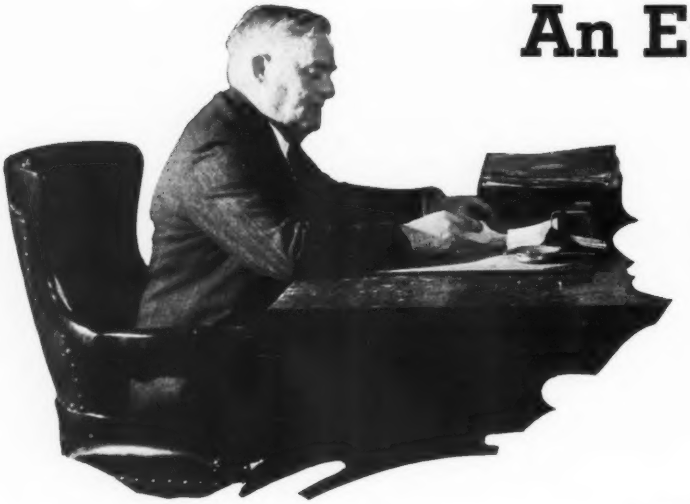
Work Equipment

A Boom to Completing Summer Programs

AS we approach the autumn season, track maintenance officers in many parts of the country are reminded that the end of their active working season is near at hand. While some of these men may be fortunate enough to have been able to keep abreast of their work programs, others find the status of their work and the conditions of their territories in an unsatisfactory condition for this time of the year as the result of curtailed allotments and forces.

On most roads there is still so much that should be done before snow flies, as to tax the ingenuity and resourcefulness of maintenance of way forces. Where adequate work equipment is available, these forces have a large advantage in meeting the schedule which is ahead of them. Where they are not adequately equipped with the necessary units of work equipment to insure high grade work and maximum performance, they are at a serious disadvantage. But whether completely or partially equipped, every road will find it to advantage to operate such equipment as they have to the fullest extent possible in the interest of maximum production and lowest unit costs.

Several roads are doing just this at the present time, catching up on programs slowed down during the summer because of restricted earnings, and, in some cases, operating special equipment two shifts a day, both to secure the maximum returns on the investment in the equipment and to permit the completing of the maximum amount of work in the time remaining. Where this practice cannot be followed, the maximum utilization of equipment during the regular working hours promises the next most effective assistance.



An Executive Looks at Maintenance Problems

By A. N. WILLIAMS

President and General Manager
Chicago & Western Indiana, and Indiana Harbor Belt

This is an abstract of an address presented before a meeting of the Maintenance of Way Club of Chicago, in which the speaker expresses full recognition of the remarkable advances which have been made in roadway and structure maintenance in keeping pace with modern operation, but calls for greater co-operation between employees and management.

THERE have been tremendous changes in the methods and materials used in the construction, maintenance and operation of our railroads, even in the last few years. The old days of untreated ties, light rail, weak angle bars, stub switches and untreated wooden structures are about out of the picture, and in their place we find rail weighing as much as 152 lb. per yd., treated ties, large tie plates, heavy angle bars, rail anchors, split switches, steel and concrete bridges and other permanent structures. Train speeds have gradually increased until today, speeds in excess of 100 m.p.h. are not uncommon.

This great progress in rail transportation has materially increased your responsibilities and you have faced and solved problems that were not dreamed of even ten years ago. In fact, the manner in which you have met the demands of present-day high-speed, heavy-train operation is one of the outstanding accomplishments of present-day railroading. This has required the combined effort of all of you maintenance of way men, and you are to be congratulated on your remarkable achievement.

Higher Standards

In considering the advances which have been made in rail transportation, we must also give credit to the work of the various railway engineering associations and to the railway equipment manufacturers who have co-operated with the railroads in the establishment of their present high standards for rail and track appliances, and for ties and bridge and building materials. These high standards have resulted in greater efficiency and in prolonging the life of all track materials and track equipment. Consider, for example, the remarkable improvements in rail during recent years, through improved metallurgical processes, refinement in composition, new designs of sections, heat treatment and controlled cooling—all of which have made a contribution to the quality and increased life of rail. Further increased rail life has been accomplished by new methods of track maintenance, by the building up of rail ends by the acetylene or electric welding processes, and by the hardening of rail ends.

A new development which has promise is the continuous welding of rail by either electric or Thermit welding; this development should be carefully followed and studied. The joint is the weakest part of the track structure, and any process that will eliminate or reduce joint maintenance expense is of the utmost importance to the track man.

Mechanized Operations

The development and use of power track tools have brought about a great change in the methods of handling maintenance work, and have materially increased the responsibilities of maintenance supervisory officers. Today, the section or extra gang foreman must have some knowledge of mechanical matters in order to operate properly and efficiently such power tools as rail laying machines, power adzers, portable power grinders, bolt tighteners, drills and tamping tools. Large, fully mechanized gangs are now employed almost universally for laying rail, and are relaying as much as two miles a day.

As the result of employing power tools, the quality of your work today is better and more uniform than ever before, and your unit costs have been reduced to a point where they largely offset the increased labor rates of the last few years. The advent of power tools has at the same time increased the responsibility of maintenance of way officers in the matter of safety, and it is essential that you train and

*Abstract of a paper presented before the annual meeting of the Maintenance of Way Club of Chicago.

watch your men daily in the safe handling and operation of high-speed power tools.

Safe Practices Important

Safety work is one of the most important of your duties. A large proportion of the total expense for which you are responsible goes for labor, and the human factor, therefore, is of first importance in your responsibilities. You and your men are exposed to the hazards presented by heat, rain, snow and extremely low temperatures. Therefore, you must always be on the alert to avoid danger and accidents to yourself and to your fellow workers.

The success or failure of safety education on your territory will depend largely upon the interest of you supervisory officers in safety. In other words, it depends largely upon whether you have become "safety-minded." The railroads cannot afford to retain in service supervisory officers who are not safety conscious. We must continue to make our properties as free from physical hazards as is possible, but we must depend on you supervisory officers to eliminate careless practices, rule violations, indifference and incompetence. Another essential in the matter of safety is the closest co-operation between foremen and their men, and between foremen themselves.

I am happy to say that the supervisory officers in the maintenance of way departments of our American railroads have made a fine record in decreasing accidents in their departments. In 1924, when a total of approximately 961,000,000 man-hours were employed, there were 27 injuries and 0.44 fatalities per million man-hours. In 1936, the last year for which complete figures are available, you reduced maintenance of way casualties to 8.9 injuries and 0.28 fatalities per million man-hours, and I know you will reduce this casualty ratio still further. Remember, every point that this ratio is lowered means less human suffering and the preservation of life and limb. Gentlemen, there is no higher calling in any line of human endeavor.

Terminal Problems

In the operation of the terminal properties with which I am associated, we do not have exactly the same problems that are encountered by road-haul carriers. At the same time, while we do not have as high speeds, we have been forced, by necessity, to run our transfer crews just as fast as possible, and we have found it necessary to spend a large amount of time and money for facilities and track construction to insure this high-speed operation. It is not efficient operation to speed up road-haul movements and then lose time at terminals. Therefore, the demands of terminal operation have been increased along with those of main-line operation, and the officers charged with the responsibility of maintaining tracks at terminals have been confronted with many of the same problems faced by the officers of road-haul carriers. In addition, terminal lines are faced with the tremendous problem of handling traffic over railway crossings at grade. This is one of the most serious problems in the safe operation of terminal properties.

Another problem which many may not have considered serious is that of trespassing, especially by children. A total of 2,569 illegal train riders and other trespassers on railroad properties lost their lives in 1937, and 2,629 trespassers were injured. Studies of such accidents indicate that approximately 50 per cent of the accidents to trespassers are fatal. During 1937, approximately 3,600,000 trespassers were removed from trains, were prevented from getting on trains, or were ejected from railroad property by 80 of our larger roads. This is an average of 300,000 trespassers per month. This problem is particularly acute at large terminals.

Economies Important

The margin of profit of the average railroad today is so small that it becomes the responsibility of operating and maintenance officers more than ever before to increase efficiency and to secure more for each dollar spent. This means constant supervision and alertness. Do you take for granted that your section and extra-gang foremen will be as diligent, for instance, in selecting the ties that are to come out of track, as you are yourself? In many cases your subordinate does not have the same knowledge of the cost of these ties as you have.

You should never overlook an opportunity to examine ties before they are burned or otherwise disposed of. You might examine hundreds of old ties before you find one that should not have been removed from the track, but if you do find such a tie and then bring it to the attention of the foreman, the object lesson will be well worth the time and effort expended. The same holds true with regard to other material which may be wasted. If you can get your men to think of material in terms of its cost, it will have a decided effect. If a trackman saw a dime lying along the track he would waste no time in picking it up, whereas if he saw a bolt lying there he probably would not pick it up, although they are equivalent in value. The proper use of material and labor is the only way that you can be successful in your endeavor to increase the efficiency of your department.

Maintenance of way officers should be on the alert to note and to report changes in conditions on their territories. These changes include business changes, new industries, new materials, new sources of supply for old materials, new potential passengers, and other factors which affect the well-being of their roads and of the industries that support them.

Must Develop Men

With the newer methods of operation, it is incumbent upon the supervisory officers of the maintenance of way department to take on increased responsibilities with respect to the selecting and training of employees for future positions. The average section foremanship or bridge foremanship today requires a higher type of man than was necessary even 15 years ago. With motorized service, higher speeds, greater refinement in design and maintenance, closer supervision is required all of the way down the line. It is the big job of maintenance of way officers, therefore, to develop, train and educate a different class of foremen than those of the days when you and I were younger.

Maintenance officers should be on the alert to pick up promising young men in their territories and to get them interested in railroad service. Put them to work as laborers, and then spend some time watching and developing them, to the end that when it becomes necessary to replace foremen you have your own men ready and trained to fill these positions. Nothing illustrates the ability of a supervisor more than for him to see that he is continuously supplied with material coming along, from which foremen and supervisors can be made when the necessity arises.

With different traffic conditions, different soil conditions, different drainage conditions, different labor conditions and different political conditions, each maintenance of way man's territory is a special problem in itself. This, however, is one of the drawing cards with which to attract the proper class of men into the railway industry. The fact that each officer has problems particular and peculiar to himself gives zest to the work of each one of us.

The work of the maintenance of way department is a fight of man against the elements, and you are constantly being tested by emergencies, such as washouts, snow blockades, sandstorms and other natural obstacles. The maintenance of way officers of the American railways have always measured up to their responsibilities, and I am confident that they always will.

Co-operation With Management

Entirely aside from the practical everyday work problems of you maintenance of way men, there are other problems of the railways which demand your attention and co-operation in their solution. As you know, the railways as a whole are in a critical condition. With our efforts blocked to secure a fair rate of return for services rendered, in the face of rapidly increasing expenses; with confiscatory legislation being proposed by state and national law-making bodies; and with a general lack of interest in these important problems by the rank and file of railroad employees, the outlook is not very encouraging.

The solution of these problems demands the attention and co-operation of both railway management and employees. There are certainly many of these problems on the solution of which we can all unite, but there have only been a few isolated cases in which wholehearted employee co-operation has been evident. Perhaps our common problems have not been placed before our employees properly. Therefore, I propose that you men assist in the task of helping to educate our employees in the value and necessity of uniting in opposition to any unfair legislation which is proposed in our state and national capitols. Certainly, our employees might well be expected to unite in supporting legislation favorable to the railways—legislation which affects them personally—yet today it is disappointing to note the lack of interest, and even opposition offered by some of our employees to the efforts of the Association of American Railroads to better the conditions of the railroads generally. It seems to me that it is high time that we should start to bring home to every railroad man the plain fact that he has a stake in this situation, that his livelihood depends upon the welfare of his road, and that in all fairness he should support the industry which supports him and his family.

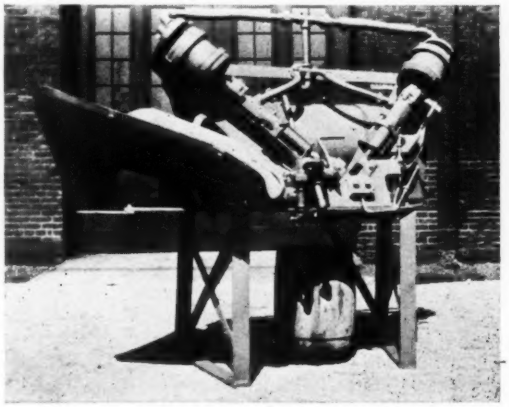
Is it worth while? The well-being of our nation depends upon our railroads, an industry which touches the lives of the people so closely that their subsistence is dependent upon it. We have an individual and collective interest in its welfare. The American railroads represent a capital investment of approximately $26,000,000,000; they form approximately one-tenth of our national wealth; they perform 74 per cent of all transportation; their payrolls, carrying a million employees with salaries totaling more than one and a half billion dollars yearly, affect directly the lives and homes of three to five million of our people.

Railroad purchases of supplies and material, amounting to approximately a billion dollars yearly in normal times, provide employment and opportunity for other millions. Railroad taxes provide a million dollars each day for the upkeep of our government. There is no question about the great economic importance of the railroads to this country. No informed or thinking person questions their necessity or value, and from your own individual standpoint, the railroads' welfare is inseparably linked with your welfare. These are the points which are of vital importance which we must bring home to our employees.

This Machine Reclaims Spikes at Rate of 21.6 Per Min.

AN air-operated spike-straightening machine, by means of which bent and twisted track spikes may be reclaimed for further use at the rate of 21.6 per min., has been perfected by S. C. Tanner, superintendent of roadway shops of the Baltimore & Ohio, and has been in use on that road for several months. This device consists essentially of two pneumatic hammers, so mounted in a fixed position relative to each other that they form a 90-deg. angle. At the apex of this angle is a V-shaped anvil block which serves as a die for straightening the spikes.

To straighten a spike, it is placed cold in the V of the anvil block and a control valve is given a quarter turn, causing both hammers to strike the spike simultaneously with sufficient force to straighten it. When the air pressure in the hammers is released by returning the control valve to the rest position, a coil spring located in the air cylinder of each tool causes the hammer to return to the raised position. During the return movement of the hammers, they operate a small slide valve that releases a jet of air under a plunger which causes the spike to be ejected from the anvil block into a keg placed under the machine.



The Spike Straightening Machine Which Is in Use on the Baltimore & Ohio

The entire unit is mounted at such a height above the floor as to permit the operator to stand in a comfortable position while manipulating the control lever and inserting the spikes into the V of the anvil block. To facilitate the latter operation a trough is provided, which carries a supply of spikes within convenient reach of the operator.

Transit-Mixed Concrete Solves Congestion Problem

The Transit-Mixed Concrete Was Unloaded Directly Into the Foundation Pit

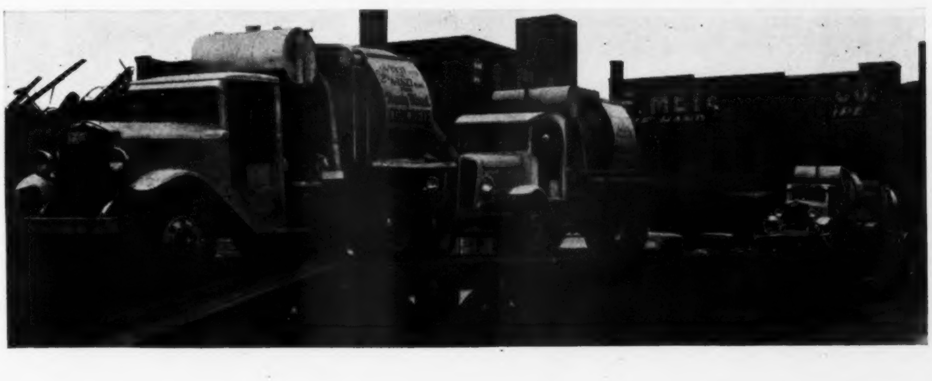
WHEN the Peoria & Pekin Union was confronted recently with a project involving the placing of a concrete foundation for a water tank in a highly congested location, it solved the problem presented by the lack of working space in a highly satisfactory manner by using transit-mixed concrete and hauling the mixer trucks to the site of the tank on flat cars.

The problem arose when the P. & P. U., a terminal railroad at Peoria, Ill., decided to replace two wood water tanks, situated at opposite ends of its freight yards, with a single 50,000-gal. steel tank which was to be located in the middle of the yard, adjacent to the yard office. For supporting the new tank, the plans called for a concrete foundation slab, 27.65 ft. square and 1.2 ft. thick, topped by four pedestals, which required a total of 67 cu. yd. of concrete. But when the railroad undertook consideration of the question of mixing the concrete, it discovered that the location of the tank did not afford sufficient space between tracks for the accommodation of a concrete mixer and stock piles. It was decided, therefore, to use transit-mixed concrete, obtaining it from a local concern, and to haul the mixer trucks to the site of the tank on flat cars.

In carrying out this plan, the foundation site was first excavated by means of a clamshell bucket attached to a rail-mounted crane, the excavated material being loaded directly into cars. On the day that the concrete for the foundation slab was to be placed, a work train, containing two flat cars, was assigned to the project, and it was arranged to pick the mixer trucks up at the site of the batching plant which is located on the railroad approximately three miles from the site of the tank and at a point where a loading platform is available. Two trucks were carried on each flat car and were loaded by operating them in reverse up on to the platform and thence end-wise on to the flat cars, which were spotted on a stub-end track. To prevent movement of the trucks after they had been spotted in the final position on the cars, planks were placed against the truck wheels in the transverse position.

After the loading of the trucks had been completed, the work train, carrying four trucks, was switched to the site of the tank and the trucks emptied, one by one, directly into the excavation, a flat chute constructed of planks being used to direct the mix to the desired place in the pit. During the first day the entire foundation slab was placed, which required 33 cu. yd. of concrete. For placing this concrete, the work train made 2 round-trips and was on the job 7 hr. 55 min. Concrete for the pedestals of the tank and for the foundation of the valve house, totalling 32 cu. yd., and for the foundation of two crane pits, requiring 9 cu. yd., was placed in the same manner several days after the pouring of the foundation slab for the water tank. The entire project required a total of 74 cu. yd. of concrete.

The work described in the foregoing was carried out under the direction of E. H. Thornberry, chief engineer of the Peoria & Pekin Union.



The Transit-Mix Trucks were Backed on to Flat Cars From an End-Loading Platform Near the Batching Plant

New Trestle Fire-Stop

The Facing Fire Curtains Form a Fire Stop Gap of Approximately 10 Ft.

CONCERNED about the large potential loss through the destruction by fire of any one of its sizable timber trestles, the Chesapeake & Ohio recently developed a new type of fire-stop, or fire-break, for these trestles, employing rigid asbestos-cement sheet curtain walls for effectively sectionalizing them against the continuous run of a fire.

One of the initial installations was made in a single-track creosoted pile and frame trestle 1,331 ft. long, in a section of old main line at Richmond, Va., now used as a connecting track with the Southern railway, while the other was made in a long section of single-track, main line, creosoted frame trestle at Cincinnati, Ohio. Both installations, except for the fact that the fire curtain material used was furnished by different companies and is in sheets of slightly different size, are essentially the same in character and details of design, and both are at points where the trestles are approximately 25 ft. high.

Wider Than Bents

The fire-stops consist of two fire curtains of corrugated asbestos-cement sheets applied continuously over the facing sides of adjacent bents, with complete enclosure of the under side of the deck within the fire-stop area with flat sheets of similar material, and a complete covering of the deck, over and between the ties, with a stone-aggregate asphalt paving mixture. The sheets making up the curtains in one of the installations are ½ in. thick, and are generally 10 ft. long by 2½ ft. wide, except where they are cut angularly to produce the flared sides of the curtains, parallel with the batter of the outside posts of the bents, while the sheets used in the other installation are ⅜ in. thick and generally 10 ft. long by 3½ ft. wide. The individual sheets in both cases are lapped top and bottom and along both sides to form a continuous surface, and each curtain is extended 2 ft. 4 in. beyond the outer limits of the bents to prevent flames from running around its edges. At the top, each curtain is carried up to the level of the top of the deck and extends out 2 ft. 10½ in. beyond the ends of the ties, having an out-to-out width of 15 ft. 9 in. at the track level.

Sheet Supports

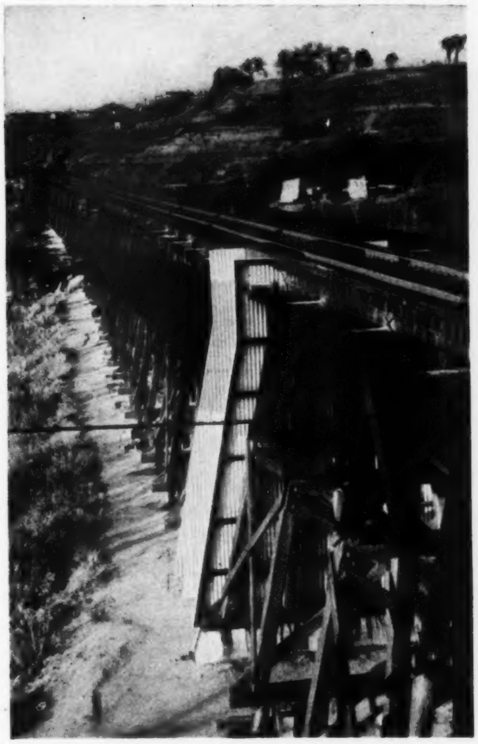
The sheets forming the curtains are mounted on a series of 4-in. by 6-in. supporting or nailing timbers, which are lagged to the face of the bent timbers with ⅝-in. by 10-in. lag screws, the heads of which, equipped with washers, are countersunk to afford a continuous flat bearing surface. These timbers are spaced to lie back of all horizontal joints between sheets, and midway the length of the sheets, and are framed into battered edge-timbers of the same size along both sides of the trestle, which provide continuous support for the outside edges of the curtains. These edge-supporting timbers are completely covered by the curtain sheets, and are similarly protected against fire on their outside faces by means of flat strips cut from the fire-resisting sheets or by angle moldings of the same material.

All of the sheets, both corrugated and flat, are attached to their sup-

The Deck Surface Between the Fire Curtains Is Paved With a Thick Layer of Asphalt Mastic Embodying Fine Stone Aggregate

Appears Effective

This article describes a new type of fire-stop developed on the Chesapeake and Ohio to sectionalize timber trestles against complete destruction by fire. Consisting essentially of two fire curtains of asbestos-cement sheets, with an entirely fire-proofed section of deck between them, the new design is economical in construction and is readily adapted to new or existing trestles of either pile or frame bent construction.

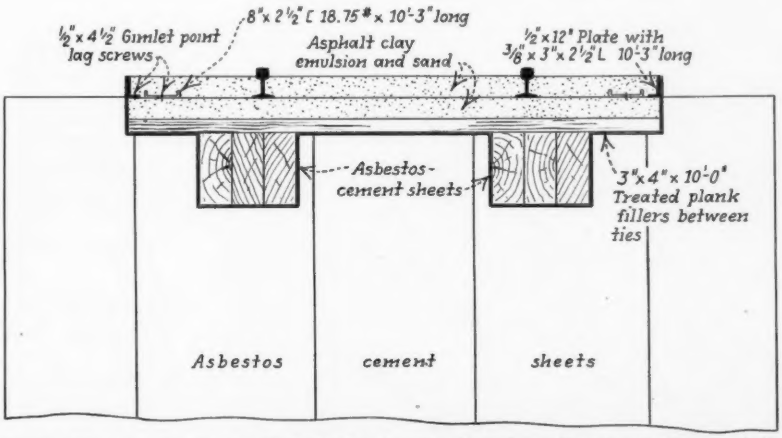


Two Additional Fire Stops of the Non-combustible Curtain Type Will Be Installed in the 1,331-Ft. Trestle at Richmond, Va.

porting framework by means of ¼-in. by 4-in. galvanized wood screws, equipped with lead washers, either concave or flat as best suited. These screws are spaced approximately 18 in. apart. In addition to fastening the curtain sheets together and to the bents along the horizontal framework timbers, they are bolted together at intervals of about 18 in. along each unsupported vertical joint with ¼-in. by 2-in. galvanized bolts, equipped with concave lead washers. Thus, each curtain wall presents a rigid, continuous, air-tight and fire-resisting surface, which is little likely to be affected by intense heat or flames thrown against it.

To make the fire-stop continuous through the deck, the under side of the deck structure is completely boxed in by flat asbestos-cement sheets, cut to size and secured in place by galvanized screws, and the top of the deck, between and over the ties to the level of the under side of the rail head, is filled in with a paving mixture of asphalt and small stone aggregate. To sustain this material between the ties, the deck was first made tight at the level of the bottoms of the ties by means of wood filler strips 3 in. thick, which, like the ties, are protected by the fire-resisting sheets which enclose the under side of deck.

To make the break in the surface of the deck complete, the outside guard timbers of the trestle are discontinued through the length of the break and are replaced with 8-in. by 2½-in. steel channels, lagged to each tie. The deck paving material is continued over these channels and is retained on each side at the ends of the ties by a 3-in. by 3-in. steel angle, welded to a 12-in. by ½-in. steel plate, which extends down and completely covers the ends of the ties. Thus, continuously beneath and over the deck structure within the fire-stop area, all timber is protected.



Section Through the Trestle Deck Within the Fire-Stop Area, Showing Enclosure of the Under-Side with Asbestos-Cement Sheets

Appear Adequate

In the original design of the fire-stop, consideration was given to facing up both sides of each bent with the fire-resisting sheets, rather than only one side, but the added protection afforded by this did not appear justified in view of the largely increased cost involved, and, furthermore, to so enclose the bents would have prevented their ready inspection. It is conceded that a fire could destroy the section of the trestle on either side of the fire-stop, and even burn out the bent immediately behind one side of the fire-stop, greatly minimizing the effectiveness of one of the fire curtains, but it is felt that the opposite unbroken curtain and the completely fire-proofed deck structure will be effective in stopping any ordinary fire, and even under the most unfavorable conditions, will retard the fire suf-

(Continued on page 546)

How the Wabash R

The Repair Shop at Decatur, Ill., and a Section Within the Shop Where Adzers Are Being Repaired

Faced with the same problem that is confronting other railways, of getting the utmost return from its work equipment and of insuring that power machines that are sent out on the road can be depended on to operate continuously and efficiently throughout the season, the Wabash has developed refinements in processes and is following modern methods of testing and repairing power units, that are already bringing attractive results in economy and dependability. In this article, Mr. Edwards describes some of the practices adopted to insure efficient and uninterrupted operation of these machines on his road.

WHEN power machines were introduced into maintenance-of-way work, certain major revisions in the methods of doing work and in gang organization became necessary. These changes were made readily without disruption to the organization as a whole, however, partly because the number of machines in service on any division was small and partly because their applications were limited. Furthermore, these early machines, such as pile drivers, bridge derricks, ditchers and locomotive cranes, were steam driven, for which reason the matter of repairs gave no concern to the engineering department, as the mechanical department was equipped to handle the repairs on such units.

Beginning with the use of motor cars, new conditions were imposed and new problems created, for the mechanical department had no mechanics familiar with internal combustion engines or their maintenance, while the engineering department had neither mechanics nor facilities for maintaining this new type of equipment. Motor-car maintenance was looked upon as a local matter and was assigned to the department that had mechanics qualified to handle it. On some divisions this was the bridge-and-building department; on others, the water-service department; and on still others, the signal department.

Expansion Brings Problems

Later, about 1916, coincident with the labor shortage occasioned by industrial expansion incident to the World War, the use of work equipment began on such a large scale that it can be said that this date marks the beginning of the industry, for many new types of power tools, all using internal-combustion engines, were developed and came into use during the next few years. This expansion in the use of work equipment was so rapid that previous experience was no guide to the methods that would be most effective in keeping it in condition for service.

Many of the earlier machines were far from being perfect mechanically and not a few of the power plants were highly inefficient and wore out quickly. With no organization or facilities for making repairs, maintenance officers were hard put to devise means for keeping the equipment in operation. On many roads, the same idea prevailed with respect to the maintenance of the new equipment that had characterized the maintenance of motor cars. In other words, it was viewed as a local matter and division officers were held responsible for the condition of the machines while in their hands.

Having no facilities for making repairs or adjustments, it was not uncommon to assign some handy man to look after the equipment, with the result that much of the work was done perfunctorily. This was particularly true of system or regional machines that were moved from division to division. Each division kept them running until through with them, but evaded the more important repairs, shifting this responsibility to the next or succeeding divisions.

Various Departments Responsible

Out of this confusion; some order was developed eventually by doing the same thing that had been done with motor cars, that is, assigning the repair work to the bridge-and-building, the water-service, the signal or the reclamation department. On some roads, general overhauling was placed in the hands of the mechanical department, while the maintenance department established a system of field inspection and running repairs. A few roads established maintenance-of-way shops in which both general overhauling and running repairs were to be cared for. These shops were generally left in charge of the department to which the repairs had first been assigned.

Regardless of the arrangement adopted, it soon became apparent that repairs to this class of equipment had little relation to the purpose for which the department that was made responsible for it had been established, and that the shop equipment and the training of the men for power-machine maintenance were both extraneous to

Repairs Work Equipment

By C. R. Edwards

Supervisor of Scales and Work Equipment, Wabash, Decatur, Ill.

this purpose. The result was that maintenance of the work equipment was relegated to a secondary place. As a further result, the repair work was poorly done and the machines were not adjusted properly, so that when delivered on the work costly delays were experienced and the value of the machines as an aid to maintenance work began to be questioned seriously.

Early Machines Imperfect

Most of the earlier machines, in addition to their other imperfections, were powered with single-cylinder, slow-speed, low-compression gasoline engines, that operated well enough to meet the demands of that day, even when improperly adjusted. With the introduction of multi-cylinder, high-speed and high-compression engines, another set of conditions was created, and the methods that had been satisfactory for repairing the older power units became obsolete with respect to the newer type.

Again, not a few of the machines were inadequately powered, with no allowances made for loss of efficiency resulting from wear. This demanded that the quality of the repair work be kept to a standard that would insure that the performance after the repairs were made would equal that when the machines were new. Any lower standard made it impossible to use the equipment with satisfaction.

To meet this situation, the Wabash established a maintenance-of-way work equipment repair shop in co-operation with the car department for the repair of all power-machines and tools, except those that are steam operated or that come under the M. C. B. rules. One of the first requirements of the new plan was to give special training to the men employed on this class of work. In addition, testing instruments and special machine tools for a variety of purposes had to be purchased; and the requirements for each type and make of the work equipment had to be studied, and tolerances for wear established.

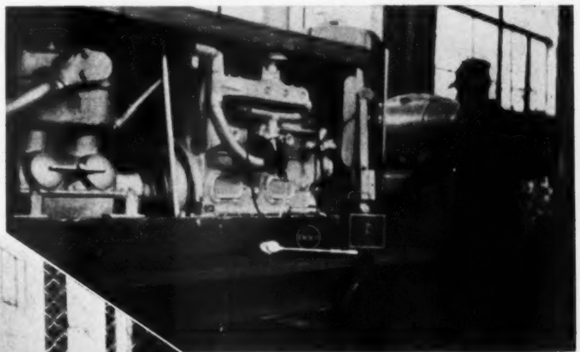
It was our former practice to rebore engine and compressor cylinders when they became cut, worn, or had excessive taper, and then fit them with oversize pistons and rings. The results were not always up to expectations, however, and this practice has been discarded in favor of the use of cylinder sleeves, which permits the cylinders and pistons to be maintained at the designed sizes, except for single-cylinder, two-cycle, motor-car engines, which we are still reboring.

Valves were formerly reconditioned on a lathe and fitted to their seats by the use of an abrasive paste. This method has also been discarded, the valve seats now being reconditioned by a special machine that gives them a glass-like finish in about one-fourth of the time required previously. When seats become too wide or battered into the block, valve inserts are installed. Despite the greatly improved methods we were using, the results still were not entirely satisfactory, however, and we began to search for the reason.

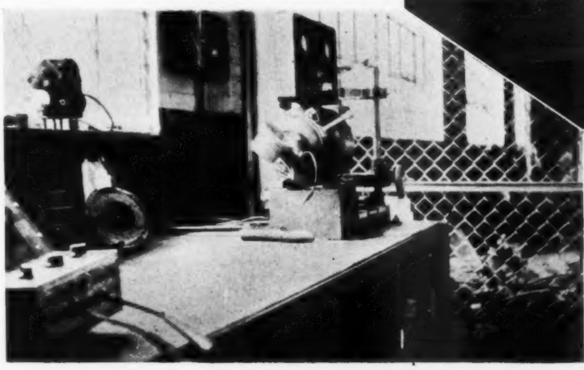
Valve Seats Distorted

In making this investigation, it occurred to us that possibly the valve seats and cylinders might have been distorted by reason of unequal tension in the cylinder-head studs. To determine the correctness of this assumption, we had one of our best mechanics tighten the cylinder-head stud nuts of a four-cylinder engine. We then measured the torque required to tighten slightly more all of these nuts, and were surprised to discover that this torque ranged from less than 600 in-lb. to slightly more than 950 in-lb.

As a result of this discovery, all cylinder-head and manifold stud nuts and bearing nuts are now tightened with a dynamometer wrench after the threads have been made friction free,



Testing the Engine of a Portable Air Compressor



The Electrical Testing Bench, Where Motors, Generators, Coils, Condensers, etc., Are Checked

so that a uniform tension is secured. Since this has been done we have also discovered that a considerable lower torque is satisfactory and that with the reduced tension, elongation of the studs and distortion of the valve seats and cylinders no longer occur.

Another practice that we have established is the grinding of that part of the piston head between the first ring and the end an additional 0.008 in. This is done to overcome the greater expansion of this area by reason of the higher temperature that is attained through immediate contact with the burning gases.

Capacity Improved

Many of the early portable air compressors were designed with the idea that only about 50 per cent of the tamping tools would be used simultaneously. This assumption is greatly in error so far as today's practices are concerned and, where these older compressors are in service, results in an inadequate supply of air for the most economical tamping, although this has been offset to some extent through the use of more modern designs of tamping tools of the low-air-consumption type.

To overcome the lack of compressor capacity, we are compelled to give special attention to maintaining these compressors at their highest practical efficiency and to insure that no compressor leaves the shop in anything less than the nearest practicable approach to mechanical perfection. Nozzles have been made for each of the sizes of compressors in use, which are designed to pass a definite quantity of air at a definite pressure and temperature, based on the volumetric efficiency of the machine when new.

When making a test with one of these nozzles, the time that the compressor works and the time that it idles are recorded. During the test the auxiliary or control valve is removed temporarily, and the gage pressure that the compressor can maintain when discharging through the test nozzle is noted. If a compressor fails to meet the standard performance which has been established for it, it is not permitted to leave the shop until the reason has been discovered and the trouble corrected. Air receivers are regularly given both the hydraulic and the hammer test, and the safety valve is set to operate at a predetermined pressure.

Before a compressor is tested, the engine must pass established tests and inspections. The ignition is checked by means of a 15,000 to 30,000-volt neon tube in series with a spark plug, the No. 1 plug generally being selected. The valve clearance and compression of each cylinder are measured and recorded. The height of the gasoline in the carburetor bowl is measured and adjusted if found to be incorrect. A vacuum mercury gage is used to determine valve action and engine performance and is one of our most valuable testing instruments.

The fuel consumption in gallons per hour is determined with the engine pulling the maximum designed compressor load, and the exhaust gas is analyzed by means of a Wheatstone bridge, comparing the gas by-products with air. This test gives the percentage of carbon monoxide, of carbon dioxide, and of power loss, and thus the percentage of combustion as well as the air-fuel ratio. This instrument, in combination with the vacuum gage enables one to make a correct carburetor setting and to select the best size for the jets and venturi tubes.

In engines that are designed to idle a part of the time, such as those on air compressors and electric welding units, it is desirable that the idling mixture be richer than the operating mixture, to insure easy starting and rapid acceleration. In engines that have ample reserve power, the operating mixture can be made more economical. Care must be taken, however, to see that the operating mixture is not too lean; otherwise there is danger of burning the valves and seats. Many experiments have proved that a carburetor on multi-cylinder engines cannot be adjusted for the best operating performance without the aid of instruments.

Magnets Recharged

For obvious reasons, it is highly desirable that ignition apparatus, starting generators and starting motors be in such condition that under average conditions they will continue to operate without interruption throughout the working season. To insure this, the strength of magneto permanent magnets is measured and these magnets are recharged if found necessary. Coils are tested, both hot and cold, for resistance, grounds and short circuits. Condensers are given a four-way test. The voltage of the ignition apparatus is measured by an adjustable discharge gap throughout the working range of speed. The output of starting motors is measured by a Prony brake, and the input is noted. A small device is provided for undercutting the mica between the commutator bars, and the brush tension of all brushes is adjusted in accordance with the manufacturer's recommendation.

Pneumatic tamping tools were formerly tested by measuring the air consumption at a definite pressure. This test was unsatisfactory because it was misleading, since a tamping tool might show low air consumption under the test, yet fail to perform properly when being driven by the warm air delivered from a portable air compressor. To overcome this, a steel box was designed, which contains a coil spring with a head to receive the tamping bar. A pointer is welded to this head and allowed to play over a graduated scale while the tamping tool is being operated, the spring receiving the blows; the number of graduations over which it plays is noted, and the air consumption during the operation is recorded.

Tamping "Guns" Tested

While it is recognized that this is only a relative test, since no attempt is made to determine the magnitude of the impact, this test is bringing to light tools that would have passed the air-consumption test alone without arousing any suspicion as to their probable performance, but which would have been unsatisfactory in actual service. Through this test it has been discovered that some of the tools which gave weak strokes had an overflow of piston metal that caused considerable friction. When this is relieved, the performance becomes entirely satisfactory. It has also been observed during the past season that the use of a light grease applied by means of an Alemite Zerk gun has reduced the wear on the tools.

We have a number of 5½-in. by 5-in. duplex, single-stage air compressors designed for use with four tamping tools. Records showed that the cost per foot for tamping with these outfits was greater than that for an 8-tool outfit. With the view of reducing this cost to a level corresponding more nearly with that of the 8-tool outfits, we experimented with two of the 5½-in. by 5-in. compressors placed in multiple, with the engines and compressors synchronized.

As a result, despite the greater gasoline and oil consumption and the increased cost of moving the two machines, we found that the footage per man was increased and the cost correspondingly decreased, compared with a duplex 7-in. by 6-in. compressor designed for eight tamping tools, because of the increased supply of air. We are now using the smaller machines to better advantage by placing them on a single chassis and syn-

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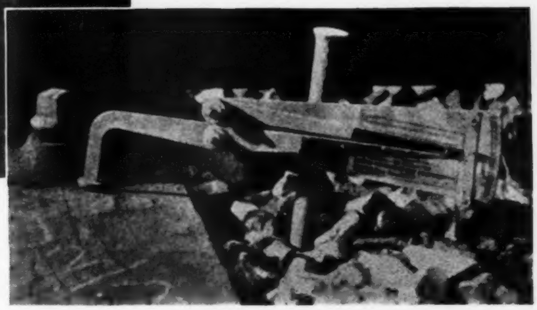
How Accurate Surfacing?

English Road Measures the Track Depression at Each Tie and Then Applies Cans of "Chippings" by Shovel Method



Above—Inserting "Chippings" Under the Jacked-Up Sleepers. Right—A "Voidmeter" in Position to Record the Movement of the Tie Under Traffic

THE availability of cheap labor and the scarcity of materials which characterize conditions in Europe have led to the adoption of certain practices in track maintenance that are of interest to the American track man largely because of the contrast afforded with practices here. Among these practices is a method of spot-surfacing track that was recently introduced on the London, Midland & Scottish of England. This procedure, variations of which are employed on other European roads, involves two major steps, namely (1) the determination of the amount of sag at each tie in the low spot, in terms of the amount of ballast required to raise the track to the desired level, and (2) the application of the requisite amount of ballast ("chippings" as it is called in England) by "shovel packing."

Measurement of Sag

The amount of sag or dip in the track is determined in two steps. In the first of these sight boards are used to measure the sag at each tie when the track is not loaded, and in the second the depression of the individual ties under the weight of a train is determined through the use of a measuring device known as a "voidmeter."

For the first measurement a set of three sighting boards, or "boning rods," is used, each of which is mounted on a short post having a clip at the lower end to permit it to be fixed readily to the top of the rail. One of these boards is provided with a horizontal sighting slit at a level such that a man seated on the rail can conveniently look through it. Another of the boards has one face divided into four rectangles, in which the vertical line is in the center of the board and the horizontal line is at the same level as the sighting slit on the other board. The squares in the second board are painted in black and yellow to provide a checkered appearance. These two boards are placed at opposite ends of the sag and are fastened to portions of the rails beyond the confines of the low spot.

The third board, which is used intermediately between the other two boards to record the amount of sag, is adjustable in height and provided with a scale so that the amount of extension required to bring the top of the board up to the level of a line between the other two boards is readily determined. The face of this board is painted half yellow and half black, with a vertical division between the colors down the center of the board. To insure that they are set up in a truly horizontal position, all three of the boards are equipped with spirit levels.

When the amount of sag in a low spot is to be measured, the foreman first determines the length of the sag by sighting along the rail, after which the sighting and target boards are fastened to the rails at points outside the limits of the low spot. Next, individual readings of the amount of sag at each tie are made and the results are chalked on the ties. This process is then repeated along the other running rail.

Use of Voidmeters

The next step in measuring the quantity of ballast required is the determination, by means of voidmeters, of the amount that the individual ties are depressed under a train. The voidmeter, a device of simple design and construction, consists of a segmental scale on which moves two pointers, one being spring-mounted so that it always returns to the original position when

(Continued on page 543)

The Office Section of the Freight House After the Completion of the Work —Note the Repainted Joints in the Brickwork

Sawdust, logs and waste lumber, in filled ground under the Grand Trunk freight station at Grand Rapids, Mich., decayed after the water table was lowered following the filling of a mill race. This resulted in irregular settlement of the building to a maximum of 10 in. This article tells how the footings were underpinned and the structure was raised to its original elevation in a manner that resulted in closing the cracks in the brick walls.

Underpinning of Freight Office Overcomes Settlement

By A. N. LAIRD

Bridge Engineer, Grand Trunk Western, Detroit, Mich.

AFTER maintaining its stability for more than 20 years, the Grand Trunk Western freight station at Grand Rapids, Mich., built 30 years ago on filled ground, began to show signs of settlement. This settlement increased gradually but unequally and eventually forced the walls out of plumb and the floor out of level to an extent that demanded corrective measures.

The site of the building is close to the Grand river and a mill race, and from the meager construction records it appeared that the possible need for pile footings had been considered when the structure was built. The plans showed spread footings, but piles were indicated by dotted lines. However, examination disclosed that no piles had been used. By means of soil tests it was disclosed that the footings rested on miscellaneous soil and sand, intermixed with sawdust, logs and timber edgings which had become decayed through drying out.

The freight-house portion of the structure settled unequally, from practically zero at some points to a maximum of about 3 in. The freight-office portion settled about 1 in. at the northwest corner adjacent to the freight house, approximately 10 in. at the southwest corner, 4 in. at the southeast corner and practically not at all at the northeast corner. An interior vault, built so that it is structurally independent of the building, settled very little.

Decide to Underpin

The freight office is 36 ft. by 51 ft. in plan, and consists of a monolithic concrete foundation wall with spread footings, 12-in. solid brick walls, and a wood floor supported by the outside walls and interior piers. The vault has an independent concrete slab support. The freight house is a continuation of the office structure, with steel roof trusses spanning the space between exterior walls.

Various methods were considered to prevent further settlement, and as the soil borings indicated a solid stratum of rock about 14 ft. 6 in. below the ground level, it was decided, as a test installation, to underpin the office portion by means of rectangular concrete piers extending to rock, and to defer work on the freight-house portion until after it was learned what difficulties would be encountered in such work, and what the approximate cost would be.

Piers Built Piecemeal

This work was undertaken by contract and carried to completion as planned with a high degree of success. The excavations for the piers were approximately four feet in width by six feet in length, measured transverse to the walls. The excavations were sheeted with heavy timber lagging as the work progressed. The material was removed by hand, one man working in each pit, and was elevated to the surface by means of a portable electric hoist and a bucket. While 11 piers were required, excavation was carried on simultaneously for only 3 piers, at widely separated locations. Considerable difficulty was encountered in some of the holes owing to the presence of logs in the fill material under the footings and also to sand which washed into the

excavation. Near the low point of excavation, considerable water was encountered, which made it necessary to operate pumps periodically.

When solid rock was reached at each pier, the bed was thoroughly cleaned and a face form was set up for the concrete in the plane of the outside face of the wall footing to restrict the width of the pier to 3 ft., the timber lagging being left in place to serve as a form for the concrete on the other three sides of the pier. The piers were each carried to an elevation approximately 30 in. below the bottom of the original footings in one pour and the concrete was permitted to cure for 7 to 10 days.

After the piers were all completed to this level, the contractor installed substantial blocking between the tops of the piers and the bottoms of the old footings and placed screw jacks under the building footings at each pier, for the purpose of raising the building to a level position. However, this work was done in successive stages so that no point was raised more than two inches per day. After each jacking operation, the building was permitted to rest for 24 hours, because it was found that about that much time was required to permit the various parts of the structure to adjust themselves to the new elevation. Each jack was given a predetermined fractional turn for the resulting lift required at each point, depending on the amount of settlement, in order to remove the distortion gradually and avoid cracks in the concrete masonry and brickwork.

Restored to Position

Prior to the jacking operations there had been a slight further settlement in the building, in spite of the fact that it was being carried on steel needle beams inserted through the foundation walls and resting on heavy mud sills. At this time there were some irregular cracks in the exterior brickwork, and the top of the end wall was in the form of a bow having a mid ordinate of seven inches at the parapet. However, as the jacking operations proceeded, the cracks gradually closed, the parapet straightened out and the interior timber roof framing returned to its correct position. No attempt was made to underpin or jack the vault foundation slab, as apparently there had been no settlement in this part of the structure. As a final operation, it was necessary to true up the office floor surface slightly and repoint a few cracks in the brickwork, but when this work was completed the building had been restored to sound condition at moderate cost.

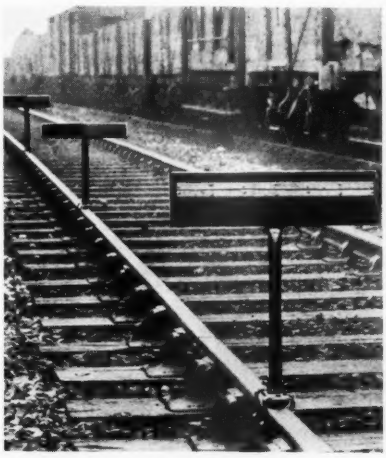
This work was performed by Hamer Brothers, Inc., contractors, under the direction of P. D. Fitzpatrick, chief engineer, Grand Trunk Western, and the writer.

How Accurate Surfacing?

(Continued from page 541)

pressure is released and the other being of the friction type so that it may be moved readily but remains at any position on the scale to which it may be moved. The end of the friction pointer opposite the indicator end is made to extend some distance beyond the pivot and a portion of the member at this end is bent at right angles to the remainder.

When in use the voidmeter is attached by means of a clamp to a steel bar about 18 in. long that has been driven vertically into the ballast at a point about 3 in. from the side of the tie and approximately the same distance from the rail. The



Sighting Boards on the Rail, Located Closer Than is Common in Practice to Permit Securing Clear Picture

device is fastened to the bar in a horizontal position at such a height that the bent end of the spring pointer rests on the top of the tie. When preparations have been completed for making the observations, both pointers are set at the lower end of the scale and both pointing to the same division mark on the scale, and are so arranged that a projecting pin on the friction pointer is in contact with the side of the spring pointer.

Thus when the tie is depressed under traffic, the end of the spring pointer moves down with it, causing the other end to move upward on the scale and to carry the friction pointer with it. After the train passes, the spring pointer returns to the original position but the friction pointer remains at the highest reading on the scale to which it was forced by the action of the spring pointer. Hence the distance between the two pointers is a measure of the maximum amount that the tie was depressed under the train. This reading is then taken and the figure chalked on the tie. Generally six voidmeters are placed on each side of the track.

The sum of the figures obtained for each tie by the static and dynamic determinations is a measure of the amount of ballast that must be placed under the tie to compensate for the unloaded sag and for the void under the tie. The total figure obtained is in "canisters" of ballast, a canister being a cylindrical metal container 3½ in. in diameter and 4⅞ in. high. To enable canisters of the same size to be used to measure ballast for ties of different widths, short horizontal slits are cut in each container at a level ⅞ in. from the top to indicate the height to which they should be filled for ties 10 in. wide. For 12-in. ties the canisters are filled to the top.

The size of the canisters is based on the use of granite "chippings" having a minimum size of ¼ in. and a maximum size of ½ in. To prepare the track to receive the "chippings," the ballast is removed from alternate cribs and the track is jacked up sufficiently to permit the clear passage of the "packing" shovel with its charge of chippings under the ties. Since only alternate cribs are skeletonized, the chippings are inserted from one side of the tie only, being spread evenly for the width of the tie and for a distance of 15 in. each side of the rail. The shovel used for inserting the chippings has a flat blade, 6½ in. wide by 8 in. long, and a specially shaped "goose-neck" handle.

When this method is used, it is pointed out that only sufficient chippings to overcome a combined sag of 1 in. are placed at any one time, and that it is preferable to establish ½ in. as the maximum and, if the sag is greater than this amount, to repeat the measuring and packing process about a week later.

This article comprises an abstract of the shovel-packing process, which appeared in our English contemporary, the Railway Gazette of London, Eng., to which we are indebted.

Practices Like This Are Conducive to Accidents in the Operation of Motor Cars and the Handling of Materials—Two of the Most Prolific Sources of Accidents

Mr. Chinn points to the manner in which the principles of safety are inculcated in the maintenance employee from the day of his employment. He emphasizes the contribution made by management and analyzes the causes of accidents to show that the responsibility rests largely with the employee.

Accidents—

A Challenge to Railway Employees*

By ARMSTRONG CHINN

Chief Engineer, Alton

THE practice of safety is civilized man's effort, in a highly complicated and technical world, to obey Nature's first law of self-preservation. Whenever we preserve ourselves from injury or death we are obeying this law, and in doing so we must necessarily practice safety.

We have achieved an excellent safety record on our railroads in the handling of passengers and a fairly good employee safety record and we are going to improve these records. How have they been made and how are we going to improve them? The safety record for handling passengers has been made because of the never-ceasing campaign for safety waged by all concerned in the safe handling of our passenger trains.

As you know, safety begins when a man applies for employment. Each applicant is given a physical examination to determine his fitness for the job for which he has applied. This examination covers his general condition, sight, hearing and ability to distinguish colors. If he passes this examination successfully, he then has to learn the rules that govern the class of work he is to do and he is examined periodically on these rules to know that he has a proper knowledge of them and of their application. If he is a foreman in the maintenance of way department, he must provide himself with a timetable and a standard watch and must know how to use them. He is also required to be familiar with all current instructions and bulletins. Also, he is given special tests to determine if he understands the rules and knows how to obey them when the necessity arises.

Inspections Important

In addition, all equipment and facilities on the railroad are constantly undergoing inspection to know that they are safe for the uses for which they are intended. Think of the inspections that are given the track and roadway to know that they are safe. The track is covered almost every day by the section foreman, the supervisor gets over it several times a week, the division engineer covers it periodically as do others who are charged with the responsibility of keeping the track in safe condition. Whenever storms or floods arise, the track is given special inspections to know that it is safe before trains are allowed over it.

Occasionally the question arises as to the extent that the railroad owners and managements are concerned in safety. No matter what rules and regulations we may have for the operation of our railroads, we cannot operate them safely without a safe plant to begin with.

Management Interest

It has often been said that a man's interest in any project can be measured by the extent to which he is willing to put money into it. Measured by that criterion, our managements have a very deep concern in the safety of our railroads. In spite of the greater cost, main line tracks are now laid with heavier rail than ever before; treated ties with larger and heavier tie plates are being used; heavier ballast sections with better grades of ballast are provided; longer and easier turnouts are installed in high-speed territories; automatic signaling is in general use; interlocking has been greatly improved; automatic grade crossing protection has been installed at many street and highway crossings; stronger and better bridges are being installed and other improvements are being made. All of these things cost money, but without them it would have been impossible to have attained the degree of safety that we have on our railroads today.

While we give a great deal of attention to safe tools, safe machinery

*Abstract of a talk presented before the Association of Maintenance of Way Foreman of the Big Four Railroad.

and safe working conditions, it has been shown by the records that 85 per cent of all accidents are due to the human element. Most accidents are the outcome of a train of events which are ultimately traceable to some human failure of foresight or insight. We can make machines and working conditions reasonably safe but we cannot make a man safe unless he is interested in safety and has the desire to be a safe worker. It has been said, and rightfully, that the best safety device known is a careful man.

A study of maintenance of way accidents on the New York Central System shows that they come from the following causes in approximately the following percentages:

Handling material	20 per cent
Operating motor cars	19 per cent
Slipping or tripping	12 per cent
Handling tools	10 per cent
Struck by trains	7 per cent
Struck by flying objects	5 per cent
Struck on foot	4 per cent
Falling	3 per cent
Burned	2 per cent
Miscellaneous	18 per cent

The accident percentages shown in this table follow closely the percentages on my own system. From this statement you will note that handling material is the cause of most maintenance of way accidents. When we think of the large tonnage of such heavy materials as rails, track ties, ballast and bridge material that is handled every year by the maintenance-of-way department, we can readily understand why most of the accidents come from this source. Reduction of this class of accident depends almost entirely on the employees. Material can be handled safely but it requires planning and close cooperation.

Human Element Most Important

In investigating accidents to employees, one large railroad that has made an unusual safety record checks the following factors: (1) Was the equipment safe; (2) was the worker working in a safe manner; (3) was the worker properly trained; (4) was the worker properly supervised; (5) was the worker in any way at fault; (6) how frequently has the injured man been injured before—was he ill—was he worried—how was his eyesight—how was his health. You will note that only one of these factors applies to equipment and the other five apply to the personal equation. A man, to work safely, must be properly trained and supervised. He should also be in the proper mental state because if he is worried about finances, family affairs, or other things, his mind will not be on his work, and he will more than likely neglect or overlook something that will result in his injury.

The total number of lives lost in all of the wars in which our country has engaged is 224,357. Our accidents from all causes and in all industries will kill that many people in the next 2¼ years. We are not giving the attention or the publicity that we should to the deaths and injuries that occur from accidents. We owe it to ourselves and to the coming generations to devise a safer way of living than we now have.

Service Records of Heat-Treated Crossings

AS seven years have elapsed since the first heat-treated rail crossings of the Bethlehem Steel Company were installed in track, records are now available to show their resistance to wear. The first of these crossings was installed in June, 1931, at the extreme north end of the approach to the North station of the Boston & Maine at Boston, Mass. These crossings are now reported to be in excellent condition and indicate a further service life of 7 to 10 years. It has not yet been necessary to build up any portion of any of these crossings by welding.

Severe Usage

That the crossings have been subjected to severe service is indicated by the number of wheels that passed over them from June 20, 1931, to January 1, 1938:

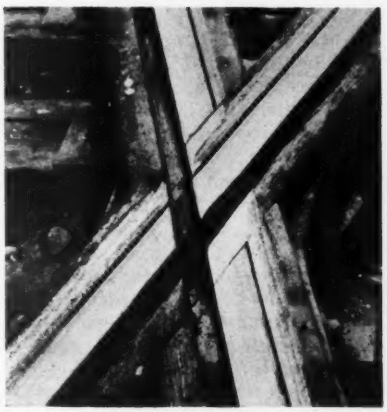
Track No.	Date Crossing Was Installed	No. of Wheels Over Crossing
1	6-20-31	17,357,018
2	6-20-31	10,464,804
3	6-20-31	7,029,792
4	2-18-34	6,295,270

The heat-treatment of crossings was undertaken a number of years ago by the Bethlehem Steel Company after exhaustive studies of the chemistry of rail steel and of requirements of the track structure.

In the process employed by this company the entire cross-section of the rail is uniformly hardened and toughened. The rails are subjected to a complete quenching and annealing treatment which requires elaborate equipment, close temperature control by multiple recording pyrometers, and adequate provision for retarded cooling. An initial hardness of 325-375 Brinell is attained. In the manufacture of bolted heat-treated crossings, component rail parts are machined from heat-treated rails, and therefore have the same physical properties as the normal rail section. The physical properties of the heat-treated rails, compared with standard rail, are as follows:

	Standard Rails	Heat-Treated Rails
Tensile strength, lb. per sq. in.	137,800	160,000
Elastic limit, lb. per sq. in.	83,000	105,000
Elongation, per cent	8.8	12
Reduction in area, per cent	12.1	30
Brinell hardness	282	325-375
Izod impact strength, ft. lb.	2	7

Rails for treatment are selected according to analysis, certain carbon and manganese ranges being most desirable. Etch tests are made before treatment to check the cleanliness of the steel, and after treatment to determine the uniformity of the results. When the need arises, heat-treated crossings can be built up by standard welding methods.



Close-Up of Portion of Heat-Treated Crossing After Seven Years' Service on the B. & M.

How Wabash Repairs Equipment

(Continued from page 540)

chronizing the engines and compressors. The piping is so arranged that either or both machines can be used, the receiver tanks being connected in multiple.

Some of the equipment used by rail gangs was being damaged as a result of being handled by the rail crane. To overcome this, we determined the center of gravity of all tie adzers, spike pullers, bolt tighteners, etc., and placed a suitable lifting bail on each of these machines, so that they can be lifted on or off the rails without damage by the rail crane.

Special end-door box cars have been provided for transporting electric-welding and rail-grinding equipment, with suitable crabs for loading and unloading, except that the crabs are not necessary for crawler-mounted welding generators. Flat cars equipped with skids suitable for loading and unloading have been provided for transporting crawler-mounted cranes and rail cranes. Consideration is now being given to cars for transporting ballast-drainage machines, with crabs which will enable two men to load and unload the machines. The idea back of these arrangements is that the cost of loading and unloading can be materially reduced.

Cleaning the Air

Special oil-type air cleaners of large capacity have been provided for engines used on adzer-cutter grinders to reduce the rapid wear induced by the abrasive dust that ordinarily gets into these engines. For the same reason, it is proposed to elevate the air intake about 8 or 10 ft. for all engines used on surface grinders while they are in operation, to insure that the air going to the engine will be taken from a point well above the cloud of abrasive dust that is carried in suspension around the grinder. All grinder operators have been provided with respirators and safety goggles to prevent them from breathing this dust or getting it into their eyes. The standardization of abrasive-wheel sizes to reduce stock and adapting them for use on grinders of various manufacturers is now receiving consideration.

Such refinements as gasoline filters, flexible gasoline conductors and the elevation of the outlets of gasoline tanks about 1 in. above the bottom of the tank to prevent sediment from getting into the pipe, have been given careful consideration and a number of these installations are now being made. Filters have also been applied to crank-case breathers of engines and air compressors that must work where abrasive material is in the air. Some consideration has also been given to the use of nitro-cast-iron sleeves for engines operating under very adverse conditions. In line with this consideration, one six-cylinder dragline engine has been equipped with sleeves of this type and with pistons fitted with ferrox rings.

Patronizes Custom Shop

The insertion of cylinder linings or sleeves, the installation of valve inserts, centrifugal babbiting (which we employ as a standard process), piston grinding and line boring are all done at a custom shop. All other work in connection with the repair and maintenance of our work equipment is being performed by railway craftsmen in a shop assigned for this purpose, and which has been arranged with the view to handling the work effectively and economically. Machines, such as ditchers, cranes, draglines, pile drivers and all M. C. B. equipment, are being repaired at the locomotive shop at Decatur, Ill. However, most of the work required on the engines with which this equipment is powered, is being done at the maintenance-of-way shop.

These refinements in processes and the methods that are being employed to carry out repairs to our work equipment are already reducing the costly delays that inevitably occur to gangs when power machines which are assigned to them fail or do not function at their best. They are also extending the life of the machines, and we are already receiving considerable benefit from reductions that have been made in the annual cost of repair parts, in addition to the benefits that come from higher mechanical efficiency.

The advent of power machines has revolutionized both construction and maintenance methods. Growth in the use of this equipment has been so rapid, however, that methods for caring for it have not always kept pace with the extension of its use, with the result that much of it has not been maintained in condition to obtain the maximum benefits that are potential in it. The railways are beginning to understand now that the economy and other benefits that this equipment is able to demonstrate are in direct ratio to its ability to give uninterrupted service. It is obvious, therefore, that the selection of dependable machines is the first step toward a realization of these benefits, and that this must be followed by high standards of maintenance. The opportunities for cost reduction through the use of work equipment are so great that all other requirements, essential as some of them are, become of only secondary importance in comparison.

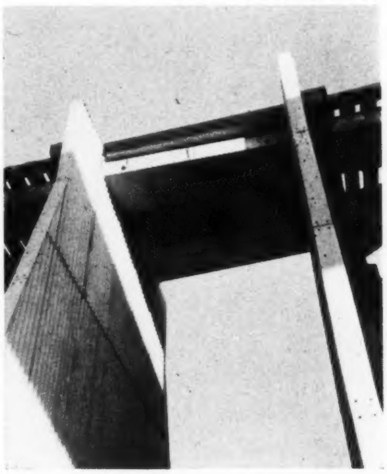
New Trestle Fire-Stop

(Continued from page 537)

ficiently to permit the effective use of such fire-fighting equipment as may be available.

Applicable to Other Types

While the fire-stops already installed at both Richmond and Cincinnati are at points in trestles approximately 25 ft. high, it is obvious that the design is applicable to new or existing pile or frame trestles of any height. Where the height is such that it is necessary to carry any part of the bracing system into the fire-stop gap, the plans call



The Under Side of the Deck is Completely Encased With the Asbestos-Cement Sheets

for enclosing each bracing timber tightly with flat fire-resisting sheets.

The stops already built were erected by the regular division bridge and building forces and cost approximately \$900 each, about \$750 being spent for the two curtain walls and \$150 for enclosing the deck structure. The fire-resisting sheets employed in the Richmond installation were of Transite, ½ in. thick, furnished by the Johns-Manville Company, while those employed in the trestle at Cincinnati were Careystone, ⅜ in. thick, furnished by the Philip Carey Company.

Who Should Place Slow Orders?

Who should place slow orders? Under what circumstances should they be placed? Who should be notified? Who should lift them? Why?

Any One Can Place

By J. B. Kelly
General Roadmaster, Minneapolis, St. Paul & Sault Ste. Marie, Stevens Point, Wis.

Any one who discovers or has been informed of a condition that is not safe for normal speed should place a slow order. Slow orders should be placed when the track or structure is not considered suitable for the prescribed speed of trains or when there is any doubt as to the safety of the track or any track structures as the result of rainfall or other weather conditions that might interfere with the track, roadbed, culverts, bridges, etc.

Instructions to place slow orders should be given to the chief dispatcher by telegraph. If telegraph service is not available the order may be transmitted by telephone, in which case it should be confirmed by mail. The chief dispatcher should furnish a copy of the order to the track or bridge foreman under whose jurisdiction it is in effect. Once every 24 hours he should furnish the supervisory staff, including the chief engineer, the division engineer and the roadmaster with copies of all new slow orders and a statement of those cancelled.

In general, the foreman who corrects the condition that has made the speed restriction necessary, or some party who may be authorized to investigate the work of correction, should notify the dispatcher to lift the order. This will prevent the possibility of misunderstanding and avoid the chance that the order may be cancelled before the condition has been corrected. Placing the responsibility directly on the shoulder of the man who must make the correction will also tend to reduce the time that the order is in effect.

Three Classes

By A. N. Reece
Chief Engineer, Kansas City Southern, Kansas City, Mo.

Slow orders should be classified generally into three groups, namely, (1) those where gangs are working, (2) those over tracks and bridges where the track gets out of line or level in ordinary operation, and which are detected by the supervisory forces in the course of regular inspection, and (3) those that are made necessary as a result of storms or other emergency conditions. In the first group where temporary moderate speed restrictions are necessary, possibly only during the working hours of the gang, the restrictive order is usually placed by the supervisor, roadmaster or division engineer when preparation is being made to start the gang. In addition to the slow order, slow flags should be placed at the proper distances during the working hours.

These orders should be removed by wire, sent jointly to the supervisor or division engineer and the dispatcher, stating that the work has been completed. Requests for slow orders should always be made in writing by the foreman, supervisor or division engineer who places the order; likewise the notices that they can be lifted should be made in writing in the form of a message.

The second group will generally account for most of the slow orders. This should be primarily the responsibility of the foreman, supervisor or roadmaster, but they should be placed also by the division engineer or any other officer, or even by enginmen or conductors who observe conditions requiring speed restrictions. Such orders should be placed by wires filed jointly to the chief dispatcher, the

Send your answers to any of the questions to the What's the Answer editor. He will welcome also any questions you wish to have discussed.

To Be Answered in November

1. *To what extent can the maintenance of a large yard be programmed? What are the advantages and disadvantages?*
2. *Under what conditions is it desirable to use wall board instead of plaster? Why?*
3. *Can rail ends be built up indefinitely by welding? If not, why? If so, what factors determine when the rail should be renewed?*
4. *What are the relative merits of the ordinary derrick car and the locomotive crane for bridge maintenance?*
5. *What practical methods can be employed to educate maintenance forces in accident prevention? Who should conduct the program?*
6. *What methods should be employed to keep tank valves from freezing in extremely cold weather?*
7. *In what ways should section forces make special preparation for winter?*
8. *Can paint with linseed oil as the vehicle be used on plaster walls? If not, why? If so, what methods of application are necessary?*

supervisor, the roadmaster and the division engineer, so that if more than a temporary restriction is demanded, slow flags can be placed or flagmen assigned to protect trains until the condition has been corrected and the order can be raised. In this case the order should be lifted by the foreman in charge of the section upon which the defect occurred, and the notice should be addressed jointly to his superior officer and the chief dispatcher.

In the third group, which includes emergency conditions, any employee, including those of the maintenance department, conductors, engineman or any others, who may observe unsafe conditions should notify the chief dispatcher by wire at once, jointly with the supervisor and division engineer, stating the speed restrictions, an accurate description of the defect and its exact location, so that additional precautions in the way of slow flags or manual flagging may be arranged for. As before, the foreman should be charged with the duty of raising the order when repairs have been completed, notifying the chief dispatcher, his superior and the division engineer.

Only the Foreman

By Joseph H. Becker
Section Foreman, St. Louis-San Francisco, Rush Tower, Mo.

Slow orders are placed primarily to insure the safety of trains, although occasionally there may be other reasons for placing them. For this reason, as a general practice, the foreman or roadmaster should place them, for through their familiarity with track conditions, they are best qualified to say what the speed restrictions should be. On the other hand, in an emergency, any one who discovers a condition that requires reduced speed should be given authority to place a slow order. In this case the dispatcher should at once notify the foreman, the supervisor and the division engineer, particularly the foreman, so that slow signals can be placed to indicate the location of the slow track.

Only the foreman who placed the order or who makes the repairs, or the roadmaster, and he only after consultation with the foreman, should be authorized to lift a slow order after it has once been placed. This is a rule that should be enforced rigidly; otherwise there may be confusion and restrictions may be withdrawn before the track is in proper condition for full speed.

All requests for slow orders should be addressed to the chief dispatcher, with copies to the roadmaster and the division engineer, and they should be in the form of a telegram. Requests for slow orders should never be transmitted by telephone if the telegraph is available; in case they are, a written confirmation should be sent by mail. Likewise, notice to lift a slow order should be reduced to writing and sent in the form of a telegram.

Keeping Work Equipment at Work

What methods can division officers employ to insure the fullest use of power machines?

Follow A Schedule

By C. L. Fero
General Supervisor of Work Equipment, Boston & Maine, Boston, Mass.

Some central authority, preferably a system department of work equipment, should handle the distribution and supervision of all work equipment. Division engineers should advise the supervisor of work equipment daily, or at least weekly, of the location of each major unit of equipment, whether working or idle, and the nature of the work upon which it is engaged.

Early in the year the division officers should give the supervisor of work equipment a detailed list of the machines needed to handle the improvement and maintenance programs for the year. Power machines for major items, such as grade or line revision, new ballast or reballasting, laying rail, and the like, should be scheduled for "all division" use by a system officer, either the chief engineer or the engineer maintenance of way, in conjunction with the supervisor of work equipment.

At the same time, a definite itinerary should be prepared covering the year's work for weed burners, weed sprayers, mowers, ballast cleaners, discing machines, rail oilers, joint oilers, bolting machines and other units available for use in completing the various programs. In practice, the plan of having the office of the supervisor of work equipment act as a clearing house for all equipment in service, whether working, idle or stored, has been successful.

One member of the division engineer's staff, say the assistant division engineer, should be responsible for allocating the machines locally, and for seeing that they are kept at work. This will insure the fullest use of all units, provided idle equipment is reported promptly, thus enabling the supervisor of work equipment to canvass other divisions with respect to their need for the idle units, and keeping them in as nearly continuous service as possible.

Finally, the use of a form suitably designed to record performance and efficiency of the power machines and their operators will aid supervisors, roadmasters, division engineers and others in checking the performance of both machines and operators. Such a form, if used properly, will reduce out-of-service time and effect economies in operation. Frequent field inspection of all classes of work equipment by the supervisor of work equipment or his representatives are also of the utmost importance in any scheme designed to obtain the fullest use of power machines.

Use in Large Groups

By Bernard F. McDermott
Roadmaster's Clerk, Chicago & North Western, Redfield, S.D.

Generally speaking, conditions are most favorable for the use of power machines where a large number of men are employed on a single class of work, and particularly where the larger gang is divided into a number of units, each of which is constantly engaged in a specialized part of the project as a whole. Obviously, if the power machine or machines serving any one of these units fails, the work of the entire gang may be thrown into confusion, for in such gangs the work of every unit must be synchronized with that of every other unit. This, then, indicates that one of the responsibilities of the division officers is to keep all machines in use on their divisions in the best practicable operating condition while they are in their charge. This responsibility is by no means lessened by the fact that there may be a supervisor of work equipment with a force of repairmen who also is responsible for the conditions of the machines.

Again, selection of competent operators, if this selection is made by the division officers, or elimination of incompetent operators if they are system employees, is an important item in keeping power machines in continuous service and in getting the largest practical output from them. They

should know the capabilities of every machine in use and should study the form of organization and the spreading of units that will give the best results in quality of work and volume of output. They should always have one or more competent operators in reserve in case the regular man is unable to continue in charge of the machine. Foremen should also be trained, not only to handle the work of their gangs, but to oversee the work of the machines and to know whether they are getting the fullest use from them. In this respect, they should be as capable within their own jurisdiction as the supervisor or roadmaster to whom they report.

In addition to these local requirements, no division can secure the fullest use of the machines which may be assigned to them unless they are working on a regular schedule which fits in with the wider program covering all divisions. Under this plan they will know when the machines will be available, how long their assignments will last, and the overall output that they will be expected to obtain from them.

Hair Cracks in Concrete

What causes hair cracks in concrete surfaces? How can they be prevented? How do they affect the structure?

Caused by Volume Changes

By M. Hirschthal
Concrete Engineer, Delaware, Lacakawanna & Western, Hoboken, N. J.

Hair cracks in concrete surfaces are caused by volume changes in the concrete while setting or hardening and, subsequently, to changes in temperature of the surface of the concrete. They may result from interaction of the concrete and steel reinforcement when the concrete shrinks in setting, whereby the steel is put in compression and the concrete surrounding it in tension. When this tensile stress exceeds the strength in tension attained by the concrete at that particular age, hair cracks are formed.

When there is no reinforcement near the surface of the concrete, these volume changes result in sizable cracks at more or less regular intervals, these distances varying with the strength the concrete has developed at the time the shrinkage occurs. It is for this reason that joints are introduced into sidewalks and floors. Reinforcement introduced to prevent these large cracks distributes the crack formation so that only hair cracks result.

To eliminate hair cracks it is necessary to continue the curing of the concrete until it develops sufficient strength to resist the tensile stress which results from volume changes. Volume changes are not the same in all concrete, varying with the type of aggregate, the kind of cement, the content of cement and the temperature and humidity, but chiefly with the amount of water used in the mixture. It may be difficult to reduce the water content and still obtain the desired workability. In addition to admixtures to obtain workability, two methods are available for reducing the water content immediately after placing; one consists of placing a "blotter" over the freshly deposited concrete to absorb excess water; the other is known as the vacuum or suction process.

If the minimum practical amount of water is used in mixing and the maximum practical amount is used for curing after the concrete has set, and this is continued for at least two weeks, hair cracks will be reduced to the minimum, if not eliminated, provided sufficient reinforcement, say 0.25 to 0.5 per cent, has been placed near the surface.

An advantage of high-early-strength cements is the short time in which the concrete attains sufficient strength to resist all types of stresses, so that with shorter curing it is a satisfactory means of reducing hair cracks. However, there is no satisfactory substitute for water curing, during the first 24 hours. After 24 hours other forms of curing, such as bituminous coatings with light-colored covering may be resorted to. In any event, the need for adequate curing to prevent loss of water from the concrete cannot be too greatly emphasized.

Where hair cracks form, the effect on the structure is negligible at first. Later, moisture works into them, freezes and thaws, so that each succeeding cycle increases the depth of the cracks until, particularly if the aggregates are not capable of resisting many cycles of freezing and thawing, spalling and possibly "popping" of the surface occurs, which in the course of time may endanger the integrity of the structure. The number of years it will take to cause this disintegration depends on the integrity of the concrete when it was deposited and its curing treatment afterwards. A well-proportioned concrete of weather-resisting aggregates, with sound cement, mixed with only enough water to give it workability, with any excess water removed, then water-cured for an adequate period, and having sufficient reinforcement near the surface, will stand through many decades of exposure without showing signs of deterioration from this cause.

Are Generally Shallow

By Assistant Engineer of Bridges

Hair cracks or crazing comprise a defect that is not peculiar to concrete, for they occur in many other materials. On concrete surfaces they may become apparent within a few days after exposure of the concrete to the atmosphere, but in some cases it may require months or even years before they develop. As concrete dries, the surface dries and shrinks first, while the interior is still wet and swollen and this accounts for the appearance of hair cracks shortly after exposure to the atmosphere. This does not account, however, for their failure to appear while the concrete is still weak and their later development when the concrete has attained a strength that should be better able to resist the stresses caused by drying. Tests made by the Building Research Board of England indicate that carbonization, which takes place upon exposure of the concrete to the air, exerts an important influence on crazing. This work showed that after initial drying shrinkage is completed, but that further shrinkage of considerable magnitude may take place as a result of the action of carbon dioxide in the air and that this shrinkage is capable of causing crazing.

Generally, hair cracks are shallow, extending through only a very thin skin of the surface. They often disappear from sidewalks and other concrete work with weathering, which removes some of the fine cement from the surface and exposes the sand and other aggregate. They may, however, develop into well-defined shrinkage cracks, and thus become points of weakness from which disintegration can begin if the concrete is exposed to weathering. While crazing may result from either shrinkage or carbonization or both, it is likely that most of the difficulty on general concrete work is caused by shrinkage from drying.

Among the means to prevent crazing, avoid wet mixes which permit

separation of materials, and methods of manipulation which bring water and fines of the cement to the surface. Bringing a thin layer of rich mortar or laitance to the surface will cause crazing. Mixes should be plastic, but only plastic enough to be placed properly; not enough to permit segregation of the materials. Many sands have a shortage of fine particles, thus permitting water separation from the remaining materials. While sand should be graded to include some coarser particles, it is important that it also contain sufficient fine particles to produce good workability and cohesive concrete. For walls and similar work, sands containing about 20 per cent of particles passing a 50-mesh sieve give good results.

Troweling plastic mixes brings water and fine cement to the surface, increasing the tendency to craze. Troweling should be delayed as long as possible. After the cement has set partially and the concrete has begun to stiffen, the surface can then be troweled to a hard finish. Cement should not be sprinkled on floors to absorb the excess moisture before troweling.

Obviously, protection of the surface against evaporation and early drying is essential. This is one of the most neglected of the precautions necessary to obtain good concrete. All surfaces should be covered as soon as possible with moisture-retaining materials. Some form of curing is often provided, but frequently curing is not started early enough, especially on horizontal surfaces and in warm dry weather when evaporation takes place rapidly. This is particularly important on top surfaces of slabs and where large areas are exposed. Forms provide good protection, but if they are to be removed at an early age, other means for protection should be provided immediately.

Restoring Flow in a Well

Under what conditions can compressed air be used to restore the flow in a well? How can this be done?

Several Methods Available

By General Inspector of Water Stations

It is not unusual for the flow in wells to be greatly decreased or stopped completely by reason of screen openings becoming closed or incrusted by mud or sand, either alone or in combination, or other deposits, which are washed into the well by the inflowing water in water-bearing strata in rock, sand or clay. Sometimes the entire bottom of the well will be plugged up to the elevation of the strainer, in which event it may be necessary to remove a relatively large amount of material.

Compressed air is sometimes used to clear the screen openings and the sand area immediately surrounding the screen by blowing back. If the deposits around the strainer are loose this method may be of some value in removing them, thus increasing the flow of water through the screen. Generally, however, compressed air is used for clearing screens only where the water is pumped by air lift, although it is frequently used in the development of new wells and in removing accumulations of sand from the interior of screens.

Usually, the methods followed in clearing screens of deposits of uncemented material are by open flushing, churning, back pressure and tool flushing. The most common method is open flushing, that is, by forcing water into the well through a wash line which extends to the bottom of the screen. In cleaning the screen the wash line is plugged at the lower end and has perforations in the pipe which allow the wash water to discharge against the other wall of the screen.

Churning consists of forcing water back and forth through the strainer. Where a reciprocating pump is used this can be accomplished by removing the foot valve and operating the pump at high speed. In other cases, a plunger which fits closely in the strainer is worked up and down creating alternately suction and pressure on the screen.

Back pressure is applied to the well by making connection to the casing and sealing the top of the well, in which case either water or compressed air can be used. The connection should be made with the pump in place so that the pressure may be applied and the well pumped alternately.

Tool flushing is carried out by inserting a tool on the end of the wash line and washing a small area of the screen at one time. The tool is constructed of rubber and metal, and when placed in the well it can be expanded against the wall of the strainer in such a way as to direct the water against any area desired. When the incrusted matter is cemented to the strainer it becomes necessary to remove the strainer for cleaning. Sometimes sand is so firmly cemented around the screen that it is necessary, after removing it, to break up the sand with a jetting reamer.

When Sand Collects

By E. M. Grime

Engineer of Water Service, Northern Pacific, St. Paul, Minn.

Basaltic or other rock formations where the water is derived by seepage through crevices in the rock sometimes contains silt or fine sand which under certain velocities may be carried along with the water and deposited in the well hole as the velocity is reduced upon entrance to this reservoir. The accumulation of this sand may gradually fill the bottom area and eventually block the well. An air line discharging at the bottom of the hole and raising the water at a rapid rate may cause sufficient agitation to dislodge this accumulation of sand or silt and allow it to be carried out of the well.

Another case where compressed air may work to advantage is in the removal of sand lodged in a well as a result of the screen developing a hole or when the slot opening of the screen is larger than is required for holding back the water-bearing medium. Removing the accumulated sand with compressed air will at least give temporary relief. It may be that the water carries considerable turbidity, mostly clay, and if the well is used infrequently, this suspended matter will settle to the bottom, and gradually fill the screen area or plug the bottom of the hole where no screen is used. This may also be corrected temporarily, and frequently for a considerable period, by cleaning the well thoroughly with compressed air.

A suitable compressor is not always available for this kind of work and where it is necessary to clean small wells, as at stock yards, stations, etc., it is frequently possible to use a locomotive air pump. The pump, drop pipe, rods and cylinders are first removed and, when everything is ready, arrangements are made with the dispatcher to use a work-train or local-freight locomotive which can be spotted adjacent to the site of the well for an hour or two, if necessary to use it this long.

The air pipe, which has been extended almost to the bottom of the well, is then connected directly to the locomotive air line and the air pump is kept in operation. As the material from the bottom is dislodged by the

high velocity of the ascending water, the air line is lowered gradually to keep it in reasonably close contact with the material that is being removed. This method will frequently involve much less expense than arranging for a regular air compressor. Track compressors used for tamping ties or other purposes can sometimes be utilized in a similar manner.

Maintaining Asphalt Roofs

What special precautions should be employed to prevent leaks in a built-up asphalt roof? To repair leaks?

Poor Workmanship

By Supervisor of Bridges and Buildings

Any type of roof deteriorates with age and as a built-up asphalt roof approaches the end of its service life, it may be expected that leaks will appear. In most cases they can be stopped temporarily, but such a roof will require frequent and sometimes expensive repairs, and it will be less costly in the long run to renew the roof. On the other hand, if leaks appear in a relatively new roof of this type, in which good materials have been used, they are an almost certain indication of poor workmanship at the time of application, or of damage after the roof was laid.

Built-up asphalt roofs are generally of the smooth-surface type, which greatly simplifies the finding and repairing of leaks. If leaks do appear, any defective or damaged material should be cut out and replaced, the new material being laid in and mopped with hot asphalt. This should then be covered with three plies of new felt, the first to extend at least 6 in. outside of the area affected, and each succeeding layer to overlap the one below it by 6 in. on all sides. Each layer of the patch should be laid in and mopped with hot asphalt.

Asphalt contains certain light oils that evaporate upon exposure, leaving the remainder dry, hard and brittle. If the roof is not given attention before this stage is reached in, say 6 to 8 years, the surface mopping will practically disappear, exposing the felt which will then disintegrate rapidly. To prevent this, before the asphalt has fully dried out, the whole roof surface should be given a light mopping of hot asphalt, at the rate of not more than 30 lbs. to the square. The roof should then require little attention for another five years. This dressing should not be repeated, but at the end of the five years the roof should be given an application of two plies of felt, laid in and mopped in hot asphalt in exactly the same manner as was done originally. If the roof is laid with asbestos felt, the dressing should be omitted as the asbestos felt will not absorb any of the hot asphalt and the dressing will fail. In this case it is better to apply a cotton fabric laid in and mopped with hot asphalt, and this can be repeated when necessary.

Maintenance Not Difficult

By General Inspector of Buildings

If an asphalt and rag-felt built-up roof has been constructed of dependable materials which have been applied properly, it should require no maintenance for several years. If leaks do occur in such a roof during the early period of its life, they can usually be traced to some form of external damage. Leaks of this character usually can be cared for by mopping two or three layers of the same material over the damaged area. The first layer should extend at least 6 in. beyond the limits of the damaged area and each succeeding layer should overlap the one below it from 4 to 6 in. on all sides.

Roofs of this type have a smooth surface, that is, they do not have a coating of slag or gravel, for which reason the light oils in the asphalt tend to evaporate and after several years the roofing will become dry and brittle. To overcome this, the roof surface should be given a dressing of hot asphalt. The interval between the laying of the roof and the time when the dressing should be applied will depend on climatic conditions and the exposure of the roof.

In applying the dressing, care should be exercised to insure that the coating is not too thick or it will crack and disintegrate. An application of not more than, say, about 30-lb. of asphalt to the square will give results superior to those that may be expected where a heavier application is made. If, on the other hand, the roof has been neglected until the original top mopping is gone and the felt is exposed and showing signs of weathering, it will be a waste of time and material to apply such a dressing. Under such circumstances the best procedure will be to clean the roof thoroughly and mop on two overlapping layers of felt with a final surface mopping as on a new roof. Small leaks in an asphalt roof that had not dried out can sometimes be stopped by the application of a plastic roofing cement.

Limitation of High Lifts

Is there a limit to the lift that can be made and still do a good job of tamping with power tamping tools? If so, why? What are the limitations? If not, how should the work of making a high lift be handled?

An Upper Limit

By H. R. Clarke
Engineer Maintenance of Way, Chicago, Burlington & Quincy, Chicago

There is an upper limit to the height of lift with which there is any advantage or economy in the use of power tamping tools, although possibly a good job of tamping might be done if sufficient time were consumed. However, no reasonable amount of tamping can compact the ballast as well as it will be done by traffic. For this reason, it is faster and more economical when a sufficiently high lift is being made, to use shovels or tamping forks, placing the ballast and tamping as uniformly as possible under the ties and then allow traffic to settle and compact it. Regardless of how the tamping may be done, to make a finished job it will be necessary to follow some distance behind the main ballasting gang and pick up the various spots that have developed under traffic. Power tamping equipment can be used to a great advantage in doing this work.

The limit to the height of economical lift depends on the kind and size of ballast being used. The larger the ballast the greater the lift that can be made. With the kinds of ballast generally used, I would say that a 6-in. lift should be the limit, and with many kinds and sizes there will be no advantage in using power tools for a lift of 6-in., the more economical limit

perhaps being 3-in. with the ballast generally used.

As suggested, in making a lift of such a height that there is no advantage in employing power tools, the original tamping should be done with shovels or tamping forks, then, after the track has settled under traffic, a smaller gang should follow, to pick up the low spots and smooth the track, using tamping tools on this work if the size and kind of ballast justify.

Ideal Lift 1½ to 2 In.

By H. F. Fifield
Engineer Maintenance of Way, Boston & Maine, Boston, Mass.

The ideal lift in stone ballast is between 1½ and 2 in., which gives ample opportunity to force new stone under the ties, and it is not so high that settlement occurs behind the lift. Where the track is to be lifted higher than this on stone ballast under heavy traffic, we sometimes do it by chucking it up with ballast forks, which is the cheapest procedure; otherwise tamping bars are used. This lift can be made up to 8 and possibly 10 in., depending on the amount of traffic and the speed which the operating department requires us to maintain on the track upon which the work is being done.

With respect to high lifts—in 1930 we did a considerable amount of grade revision under traffic, with total lifts up to 12 ft. These lifts were made in steps up to 12 in., using hand-made spuds for the first tamping, which was the maximum that could be made with one unloading of gravel. From 1 to 2 weeks were allowed for compaction under traffic before the final surfacing was done with bars, the raise for bar tamping being from ½ to 2 in.

Better to Make Two Lifts

By W. H. Sparks
General Inspector of Track, Chesapeake & Ohio, Russell, Ky.

The best lift for power tamping is from 2 to 3 in. This will insure solid packing of the ballast in place and is more likely to insure a permanent smooth running surface. As the lift increases in height it becomes increasingly difficult to control the tamping and be certain that it is evenly packed, for the powerful stroke of the tamping tools tend to drive the ballast through to the crib on the other side of the tie. A total raise of 4 or more in. should be made in two lifts, the tamping of the first lift to be made with shovels or ballast forks, and the final lift with power tampers. A considerable interval should elapse between the two lifts to allow traffic to compact the ballast first applied and thus prepare a solid bed to support the ballast and ties after the second lift is applied. Personally, I believe that track can be maintained better by making light lifts at short intervals than by making high raises less often, provided there is sufficient ballast below the ties to start with.

6 In. the Limit

By J. E. Emond
Roadmaster, Atchison, Topeka & Santa Fe, Clovis, N.M.

A lift of not more than 6 in. can be made and still do a good job of tamping with power tools. If a lift of 8 or 10 in. must be made, one should make the first lift to within 1 in. of final grade, tamping the ties over their full length with shovels. If the tamping has been done uniformly, the settlement will be uniform except for low spots here and there which can be cared for without difficulty. The track should then be allowed to run for 30 days to allow thorough compaction by traffic, when the settlement will be about 1½ in. leaving 2½ in. for the finishing lift. It can run for 60 days without harm. Power tools should be used in the finishing lift, and the ties should be thoroughly tamped from the ends to 17 in. inside the rail, and ballast should be shoved under the center of the tie with a ballast fork simply to fill the space. Tamping the full length of the tie at this time will invariably result in center-bound track.

On the first lift it is necessary to tamp the full length of the tie; otherwise the ballast will work into the open space at the center and cause uneven settlement. On the other hand, if the ties are tamped over their full length on the final lift, the weakest point will be at the ends and the track will become center bound.

It is possible to make the first lift with power tampers, with as good results as with shovels, but there is no point in doing so, for the progress will be slower and the cost of operating the machines will make the cost higher. Another advantage of this method is that tie renewals can be made more economically in connection with the first lift, and the tamping of the second lift will stand up better if no ties are renewed at this time.

Advantages of Prepared Paints

What are the relative advantages and disadvantages of ready-mixed paints for bridges and exterior of buildings? For the interior of buildings?

Prefers Prepared Paints

By General Inspector of Buildings

Some years ago the stores department on our road manufactured all of the paint we used for buildings, bridges and cars, except certain special paints that were used infrequently. The officers of this department insisted that they could make the paint at a lower cost than the purchase price of ready-mixed paints. Perhaps they did, but I doubt whether the ultimate cost was less, for much of the paint they turned out was not satisfactory. Few of the successive batches matched exactly in color and sometimes this variation was wide where the intervals between batches was long.

Our painters complained that some of the paint did not apply satisfactorily and fading was common, while the life of the paint was comparatively short. This was particularly noticeable on bridges, for we experienced considerable trouble in keeping them properly protected against corrosion. In the light of later experience I have come to believe that in an effort to keep costs down, the raw materials were bought on the basis of cost rather than quality. The equipment was limited; I have been told that it was out of date, and little control was exercised during the manufacturing operation, so that the output lacked uniformity.

Later, we prepared our own specifications and had the paints manufactured. This brought some improvement, but they were still afflicted with the same defects as those of our own manufacture, although in less degree. One trouble with this scheme was that in an effort to get better paint we were always revising the specifications so that the paint received in successive years was not uniform with that purchased previously.

Today we are buying prepared paints, some ready mixed and some in paste form which we mix ourselves. We are generally buying on brand, relying largely on the manufacturer's reputation, although we keep a record of the performance of all paint applied to both bridges and buildings

where complete repainting is done. We find this practice far superior to our former practices, as we are now getting paint of good quality and uniformity. The only difficulty we have not yet ironed out is that of color, for different manufacturers seem unable to match our color card exactly. As a result we find it necessary to use the same brand of paint on all of the buildings in any group.

Prepared Paints Best

By E. C. Neville
Bridge and Building Master, Canadian National, Toronto, Can.

There are many advantages in the use of mixed paints. In the first place, reputable paint manufacturers cannot afford to turn out an inferior product if they hope to stay in business. They have properly equipped laboratories for testing materials and controlling manufacturing processes and for determining the best materials to use under different conditions of surface and exposure. They also have adequate equipment for grinding and mixing, which should insure a higher grade of paint having a more uniform texture than can possibly be produced by hand mixing or inferior facilities.

For these reasons, one who uses ready-mixed paint produced by reliable manufacturers is assured of high quality and uniformity in both materials and mixture. This applies more particularly to bridge paints than to paints for the exterior or interior of buildings, but even in building paints one is certain of uniformity in quality. The only disadvantage with respect to building paints lies in the fact that if small lots of different colors are required, it may be more economical to mix these by hand. But where hand mixing is resorted to, care must be taken to mix a sufficient quantity of each color to complete the job, for it may be extremely difficult to match the colors when the second or succeeding batches are mixed.

Reliable paint manufacturers are most desirous of maintaining a good reputation and frequently refuse to make paints to a buyer's specifications if they happen to be inferior to their own product. As a consequence, if reasonable care is used in buying, it is safe to say that the advantages are all on the side of ready mixed paint, except as has been mentioned above.

Rail Design and Joint Freezing

Do rail joints freeze more easily on some sections of rail than on others? If so, why? On what sections? Does the design of the joint make any difference?

Less Wave Motion

By C. W. Baldridge
Assistant Engineer, Atchison, Topeka & Santa Fe, Chicago

Such investigations as I have made indicate that joint bars tend to freeze more easily as the rail sections increase in size and stiffness. This raises an interesting question as to the reason for this phenomenon. Apparently this occurs because in the heavier and stiffer rails the amplitude of the wave motion is less than in the lighter rails, thus reducing the tendency to break the grip between the joint bar and the rail. Furthermore, the greater weight of the larger sections resists the longitudinal movement of the rail, resulting in less movement in expansion and contraction.

It seems quite certain that the design of the joint does have some bearing on the action of the bars in this respect. It is well known that the greater the movement between two bearing surfaces the greater will be the wear. Again, the less the area of contact between these surfaces, other things being equal, the more quickly will the bearing surfaces wear. Consequently, rail joints which have the least area of bearing surfaces will wear away more rapidly, causing looseness between the rail and the bars. Those joints which have the greatest area of contact will wear more slowly and maintain a good fit and good surface longer, but there will be a larger number of frozen joints.

Tests which have been made with continuously welded rails indicate that if all joints could be kept frozen all of the time, there would be an advantage in doing so. Where most of the joints are frozen and slippage occurs at an occasional joint, the result is likely to be a pair of sheared bolts and an open joint when the temperature drops and the rails contract.

Long joint bars with wide bearing surfaces between the bars and the rail produce more frozen joints than the shorter bars, but they also produce more uniform surface with less batter at the rail ends. They thus carry the wheels more smoothly and retard the formation of low spots in the track, with a consequent saving in maintenance expense.

They Seem To Do So

By Engineer Maintenance of Way

It had been noticed that since we began to lay the heavier rail sections, 112 and 131 lb., more joints become frozen than on the lighter rail. At first we thought this was more or less fancy, but investigation indicated that it is so. We have sought for an explanation, and have come to the conclusion that the weight and stiffness of the rail are important factors and that the fit and design of the joint bars also have some bearing on the matter.

The weight of the rail in itself produces additional restraint against longitudinal movement so that the movement in expansion and contraction is less and thus there is less relative movement between the rail and the joint bars as a result of temperature changes. As the rolling wheel loads pass over the joint assembly they cause vertical movement in the rail and joint bars, and relative movement between the component parts of the assembly. When two metal surfaces are in contact, the amount and rate of wear will depend in part on the amount of movement between them and on the area of the bearing, that is, the smaller the area of the bearing, all other conditions being identical, the greater the rate of wear.

It is obvious that as the rail section increases in stiffness the vertical movement under the rolling loads will decrease and that this will reduce the amplitude of the relative movement between the joint and the rail. It has been observed that 6-hole bars freeze more easily than 4-hole bars, the explanation being that since the large bars have a greater area in contact with the rail, the amount of wear is practically negligible for some time and so tight a fit is maintained between the bearing surfaces that they freeze together.

It has also been observed that symmetrical bars freeze more readily than joints of the angle-bar type. As the joint is depressed under the action of the moving loads, a warping or twisting occurs in the angle bar by reason of the horizontal flange, which accentuates the movement between the bar and the rail and helps to overcome any tendency to freeze. This twisting does not occur if the bars are symmetrical. Apparently the greater tendency of the joints to freeze in the heavier rail is explained by reduced movement between the component parts of the joint assembly.

What Our Readers Think

Inspecting Ties

Russell, Ky.

To the Editor:

I was particularly interested in the discussions on inspecting ties after they have been removed from the track, which were published on page 268 of the April issue. Although Messrs. Chinn, Banion and Perlman did not agree entirely, each made a good case for his point of view, and both discussions contain arguments that should not be passed over lightly but should be given thoughtful consideration by maintenance officers.

Few roads handle their tie inspections and tie renewals exactly alike, although I believe that the ultimate objective of getting the maximum life out of every tie inserted is the same on all roads. In other words, since ties represent the largest single item in the cost of track maintenance, the officers of this department are alert to reduce this cost to the practical minimum. This is a matter that is watched very carefully on the Chesapeake & Ohio.

Our supervisors, accompanied by the foreman on each section, go over their track in the fall, after the tie renewals for that year have been completed, and spot the ties that in their judgment should come out during the following year. After the reports for all of the districts have been received, the assistant engineer maintenance of way, the chief tie and timber agent, the respective division engineers and track supervisors, and the general inspector of track, start out. This group visits every supervisors' district, walking over certain selected miles on each district, and making a detailed examination of the ties on these miles. The results of this recheck are compared with the original estimates and necessary adjustments of the supervisors' estimates are made. Since the division officers do not know beforehand the miles that will be selected, it is believed that the recheck of a few miles is representative of the conditions on the remainder of the district.

These revised estimates are given to the division officers as soon as completed, so that they can make their plans accordingly. Foremen and supervisors are aware that their estimates will be checked, because this system has been in effect for many years. Yet, it is an interesting fact that, in general, the estimates are reduced instead of increased, although the latter sometimes happens. Despite this, however, our tie condition has improved noticeably in recent years and was never better than at present. Obviously, other factors than the check inspection have affected our tie condition, including more rigid adherence to tie specifications, better seasoning and treating methods, larger tie plates and other conservation methods that have been developed from time to time.

I have often been asked by general officers whether I believe that the time and effort involved in making the check inspections are worth while. I have invariably answered that I am convinced that they are. No foreman or supervisor can fail to be impressed by the fact that his superior officers are taking a definite interest in his tie renewals, as well as other features of his work that are discussed with him on these trips. For this reason they have an educational value of considerable importance. Conversely, the officers who make the inspection come back with a far more intimate knowledge of the property and its needs than they are likely to get in any other way, no matter how much time they spend on the road at other seasons. Again, it is not entirely a question of reducing tie renewals, for it is as important to see that the tracks are adequately tied as to see that they are not over tied.

Where so much attention is given to the inspection of ties before they are removed, and where foremen are educated to be careful to remove no ties that still have service life left in them, I can see no useful purpose in making an inspection after they are out of the track. There may be special cases where this may be advisable on occasion, but as a general practice I would say that it is wasted effort. It is better to keep the water from going over the dam than to try to salvage it after it has passed.

W. H. Sparks,
General Inspector of Track,
Chesapeake & Ohio.

New Books

A. R. E. A. Proceedings

PROCEEDINGS of the American Railway Engineering Association for 1938—920 pages, 6 in. by 9 in. Bound in cloth or half Morocco. Published by the association, 59 East Van Buren street, Chicago. Price, cloth \$8, half Morocco \$9.

The current volume of the proceedings contains a complete record of the work of this association for the year 1937-1938, ending with the activities of the thirty-ninth annual convention, held in Chicago on March 15, 16 and 17, 1938. It not only indicates the large amount of detailed work carried out by the association in the interest of improved rail transportation, but also clearly evidences the widened scope of activity on the part of the association and its enlarged interest in research and in field and laboratory technique as a means of solving many of the problems which are today facing engineering and maintenance officers.

The feature of the proceedings, as in past years, is the presentation in full of the committee reports presented at the convention, together with the discussion which followed the verbal presentation of each report. The volume includes the reports presented by 27 standing and special committees of the association, covering a total of 122 subjects, and, in addition, contains a report of the business session of the convention and an address by Charles Donnelly, president, Northern Pacific railway, before the annual luncheon of the association on March 16, 1938.

Among the committee reports presented are five relating to railway buildings; six relating to masonry structures; three relating to iron and steel structures; seven relating to water service, fire protection and sanitation; seven with regard to yard, terminal and shop facilities; three with reference to wood preservation; five with regard to roadway matters; six with regard to cross-ties; eleven having to do with rail and related subjects; seven with regard to track; four with reference to highways; eleven concerning matters relating to the economics of railway location and operation; nine having to do with the economics of railway labor; six with specific regard to maintenance of way work equipment; and two relating to waterways and harbors. In addition to these general reports, the proceedings presents a number of new or revised specifications and plans acted upon at the last convention.

NEWS of the Month

New Haven Announces Rail-Auto Service for Passengers

The New York, New Haven & Hartford has announced a plan in which reduced mileage rates on Hertz "drive-ur-self" automobiles will be offered to its passengers in nine cities on its lines. The plan is designed particularly to appeal to traveling men who may use the trains between cities and the rental cars in each city to make calls in the surrounding territory.

Big Four Foremen Hold Annual Meeting

More than 200 members and guests attended the sixteenth annual convention of the Association of Maintenance of Way Foremen of the Big Four, held at Cleveland, Ohio, on August 26 and 27. Supplementing a program of reports and discussions, the meeting was addressed by J. V. Neubert, chief engineer maintenance of way, New York Central System; Geo. S. Fanning, chief engineer of the Erie; and J. B. Martin, general inspector of track, New York Central.

Wage Negotiations Fail—Mediation Invoked

Wage negotiations at Chicago between the Carriers' Joint Conference Committee, and the Brotherhood of Railroad Trainmen and the Railway Labor Executives Committee, representing 18 organizations of railway employees, on the carriers demand for a 15 per cent wage cut reached a stalemate and were terminated on August 3 and 4. Services of a national mediator, the next step authorized under the Railway Labor Act, were invoked, and hearings were begun in Chicago on August 11, by the board of mediation consisting of three members, William H. Leiserson, chairman, George A. Cook, and Otto S. Beyer.

Railroads Handle Record Wheat Shipments Efficiently

New records were established this year by the railroads in the handling of the largest wheat crop since 1915, when receipts at Kansas City, Mo., the largest and most important grain market in the United States, for the week ending July 8, totaled 9,714 cars, the largest on record. The previous record, which was established in 1937, was 9,009 cars. In spite of these records, the loadings, which normally take place in a few weeks, are being spread this year over a longer period of time, because of wet weather in many localities, which caused a return to the slower thresher and binder methods of harvesting; the program for government loans on wheat, and the low prices for grain.

Common Stock Wiped Out in C.G.W. Reorganization Plan

In an effort to develop a depression-proof corporate structure, the Interstate Commerce Commission has approved a plan of reorganization for the Chicago Great Western in which fixed charges were drastically reduced, and in which the equity of the common stock holders is eliminated. In this plan preferred stock holders will receive new common stock on the basis of 25 per cent of their holdings. Similar plans for reorganization of the Denver & Rio Grande Western and the Chicago, Indianapolis & Louisville (Monon), have been sent to the commission by its examiners, in which it is recommended that both the preferred and common stocks be accorded no consideration in the reorganization. These plans, if adopted, will eliminate control of the D. & R. G. W. by the Western Pacific and the Missouri Pacific, and control of the Monon by the Louisville & Nashville and the Southern.

Olympian Accident June 19 Caused by Undermined Piers

The disastrous accident to the westbound Olympian of the Chicago, Milwaukee, St. Paul & Pacific at Custer Creek, near Saugus, Mont., at 12:35 a.m., June 19, as reported on page 423 of the July issue, was caused by unprecedented flood conditions which undermined several piers of the structure, according to a report issued by the Interstate Commerce Commission.

The bridge, a single-track steel and reinforced concrete structure of seven spans, 180 ft. 3¼ in. long, was completely demolished. Evidence brought out that the structure conformed to the design specifications of the American Railway Engineering Association, and that at no time prior to the accident had its safety been questioned. It was also brought out that in making an inspection of adjacent territory where rain had been reported, the section foreman stopped to make a general inspection of the bridge at about 10:20 p.m., at which time the water passing beneath it was not sufficient to cause any alarm.

It was the consensus that the bridge was intact when the Olympian approached it but that the upstream ends of Piers 2 and 3 had been undermined by the scouring action of the swift current, causing the bridge to collapse under the weight of the train. According to the report, the channel opening of the structure was sufficient for even the volume of water at the time of the accident. On the other hand, it stated that the scouring of the pier footings to such an extent that the piers were moved from their normal locations, is evidence that the footings did not extend far enough below the stream bed to withstand the great volume of rapidly-moving water which was presented at the time of the accident.

Freight Rate Differentials Handicap Southern Industry

The National Emergency Council declares the freight rate differential to be the major problem which faces all industry in the South, in section 14 of a 60 page report made public August 13, in response to a recent request of President Roosevelt for a concise statement of the needs and problems of the South. In the report it was stated that the manufacturer in the Southeastern section of the United States who ships goods into the Northeastern territory is under a relative disadvantage of approximately 39 per cent in freight charges as compared with rates for similar shipments entirely within eastern territory. It is also claimed that the original reasons for higher rates in the South, which were the higher cost of railroad operation and a light traffic density, have disappeared.

Further Developments on the Rutland

Employees on the Rutland on August 3 accepted under protest, and subject to the outcome of the national wage negotiations, a reduction in wages varying from 10 to 30 per cent, based upon a sliding scale of their regular wages, following instructions issued by Federal Judge H. B. Howe to L. G. Morphy, receiver of the Rutland, that such a reduction would be necessary after August 4, if the Rutland was to continue operation, and that employees not willing to help the Rutland by accepting these terms should stop working. Citizens and business houses in towns along the line are contributing to the "Save the Rutland Club," and the city government of Rutland, Vt., voted to abate water assessments levied on the road for a period of one year and to contribute $1000 cash (a total contribution of over $3,500).

Association News

Bridge and Building Association

A meeting of the Executive committee was held in Chicago on August 27, with President C. M. Burpee, Vice-Presidents F. H. Masters, Armstrong Chinn and F. H. Cramer, Secretary-Treasurer C. A. Lichty, Director R. E. Dove and Past-Presidents C. R. Knowles, F. E. Weise and Elmer T. Howson, in attendance. After completing the details for the forty-fifth annual convention, which will be held at the Hotel Stevens, Chicago, on October 18-20, attention was concentrated on the drafting of a program for this convention and to the review of the committee reports, all of which are now completed and in the hands of the secretary, except one which will be completed before September 15. In this respect, the work is further advanced than in any recent year. The character of the reports insures a highly successful program.

Bridge and Building Supply Men's Association

A number of companies that have long exhibited at the conventions of the American Railway Bridge and Building Association are now considering the advisability of asking for a reconsideration of the decision reached a few weeks ago, as reported in the August issue, to abandon the exhibit this year. This action is being stimulated by the success of other conventions recently held and in prospect and by the constructive character of the program to be presented at the Bridge and Building convention. K. T. Batchelder, manager of railroad sales of the Insulite Company, Chicago, is president of the association.

American Railway Engineering Association

During the latter part of September, the secretary's office will mail to the membership the September-October Bulletin, No. 405, and sometime during the month it expects to be able to send to holders of the Manual the loose-leaf supplements to the Manual, necessitated by the action taken at the last annual convention, March 15-17. The loose-leaf supplements, which have been submitted to the Association of American Railroads for approval before distribution, include a completely revised contents section involving 8 sheets, 73 sheets of body material, 31 sheets of general index, and 6 folded inserts. Bulletin No. 405 will include the reports of 11 committees of the Electrical section, Engineering division, A.A.R., and also a report by F. M. Graham, assistant engineer standards, Pennsylvania, on "Damage to Wooden Crossties from Tie-Plate Penetration and Abrasion."

Only two committees held meetings during August, that on Buildings, at Detroit, Mich., on August 10, and that on Economics of Bridges and Trestles, at Chicago, on August 26, but eight committees have scheduled meetings for September, of which five will be held in Chicago at the time of the convention of the Roadmasters and Maintenance of Way Association. These latter committees, with the dates of their meetings, are as follows: Maintenance of Way Work Equipment, on September 19 and 20; Roadway, on September 20; Track, on September 20; Economics at Railway Labor, on September 21; and Rail, on September 21. Other committees to meet during the month are the Committee on Uniform General Contract Forms, at New York, on September 12; the Committee on Water Service, Fire Protection and Sanitation, at Chicago, on September 13; and the Committee on Yards and Terminals, at Hershey, Pa., on September 26 and 27.

Track Supply Association

Forty-three exhibitors have now arranged for 62 spaces at the annual exhibit to be presented in conjunction with the Roadmasters and Maintenance of Way Association. Companies which have arranged for space, in addition to those listed in the August issue, page 506, include:

Differential Steel Car Co., Findlay, Ohio

Kalamazoo Railway Supply Co., Kalamazoo, Mich.

Lundie Engineering Corp., New York

S. E. Rawls Co., Streator, Ill.

With three weeks remaining for the receipt of additional applications, this assures an exhibit comparable in size with that of last year and exceeding those of any other recent year.

Roadmasters Association

A meeting of the Executive Committee was held in Chicago on August 8, attended by President W. O. Frame, Vice President A. H. Peterson, Secretary C. A. Lichty, Directors R. L. Sims and R. H. Carter, and Past President Elmer T. Howson. At this meeting final details for the convention were acted upon and the reports of committees reviewed. Membership diplomas, which were authorized at a recent meeting of the Executive Committee have now been completed and are being distributed to those members in good standing.

The program for the fifty-third annual convention, which will be held at the Hotel Stevens, Chicago, on September 20-22, is now practically completed. All reports are completed and in the hands of the secretary, while acceptances have been received from practically all of those who have been invited to address the meeting. The program is as follows:

Tusday, September 20
Morning Session—10 a.m.

Convention called to order

Opening address by William Atwill, vice president and general manager, Illinois Central, Chicago

Greetings from the American Railway Engineering Association, F. E. Morrow, President

Greetings from the American Railway Bridge and Building Association, C. M. Burpee, President

Address by President W. O. Frame (assistant division superintendent, C. B. & Q., Wymore, Neb.)

Report of Committee on the Materials and Equipment for the Section Gang of Today; M. D. Carothers, Chairman (division engineer, Alton, Bloomington, Ill.)

Afternoon Session—2 p.m.

Report of Committee on The Maintenance of Line and Surface to Meet Present Day Operating Requirements; E. L. Potarf, Chairman (district engineer, C. B. & Q., Omaha, Neb.)

Address on Using Track Labor Efficiently, By F. S. Schwinn, Chairman, Committee on Economics of Railway Labor, A.R.E.A., and assistant chief engineer, M. P., Houston, Tex.

Report of Committee on the Elimination of Train Derailments Resulting from Track Defects; A. B. Hillman, Chairman (roadmaster, Belt Railway, Chicago)

Adjournment to inspect exhibit of Track Supply Association

Tuesday Evening—8 p.m.

An evening of motion pictures, showing the United States Steel Corporation's Technicolor film illustrating the manufacture of steel

Wednesday, September 21
Morning Session—9:30 a.m.

Report of Comimttee on The Maintenance of Turnouts; F. J. Liston, Chairman (roadmaster, C. P., Montreal, Que.)

Address on The Roadmaster's Job, by Fred G. Gurley, assistant vice president, C. B. & Q., Chicago.

Report of Committee on the Programming of Track Work; S. J. Hale, Chairman (roadmaster, N. & W., Roanoke, Va.)

Afternoon Session—2 p.m.

Address on Better Track Construction for Tomorrow's Traffic, by F. R. Layng, chief engineer, B. & L. E., Greenville, Pa.

Question Box—For the discussion of practical questions on track maintenance submitted from the floor

Adjournment to visit exhibit of Track Supply Association

Wednesday Evening—6:30 p.m.

Annual dinner given by Track Supply Association

Thursday, September 22
Morning Session—9:30 a.m.

Report of Committee on Methods of Instructing Track Men in Safety; F. E. Schaumberg, Chairman (roadmaster, C. & N. W., West Chicago, Ill.)

Business session

Report of officers and of committees

Election of officers

Selection of 1939 convention city

New business

Installation of officers

Thursday Afternoon—12:15 p.m.

Members of the association will visit the plant of the Pettibone-Mulliken Corporation where they will have opportunity to observe the construction of special track materials.

Personal Mention

General

J. C. Jones, roadmaster on the Canadian Pacific with headquarters at Regina, Sask., has been promoted to assistant superintendent, of the Saskatoon division, with headquarters at Wynyard, Sask.

Frank Simpson, chief clerk in the office of the chief of transportation of the Canadian National, has been appointed assistant to the vice-president of operation, with headquarters at Montreal, Que. Mr. Simpson was for many years associated with engineering and construction work on the Grand Trunk Pacific (now a part of the Canadian National) and on the Canadian National, serving at one time as secretary to the chief engineer, and later in the office of the vice-president of operation and construction at Montreal.

Quin Baker, division engineer of the Northern division of the St. Louis-San Francisco, with headquarters at Fort Scott, Kan., has been promoted to assistant superintendent at that point. Mr. Baker was born at Welda, Kan., on October 18, 1894, and attended Kansas University from 1913 to 1915 inclusive. He entered railway service on June 6, 1916, as a chainman in the engineering department of the Frisco at Springfield, Mo., and was later promoted to rodman. After service in the U.S. Army in 1917 and 1918, he returned to the railway at Springfield and was promoted to transitman. On March 1, 1920, he was promoted to assistant engineer at Sapulpa, Okla., and later to roadmaster. On May 1, 1933, Mr. Baker was promoted to division engineer with headquarters at Ft. Scott, where he remained until his recent promotion.

Walter D. Pearce, assistant superintendent on the Northern Pacific, with headquarters at St. Paul, Minn., and an engineer by training, has been promoted to superintendent of the Yellowstone division, with headquarters at Glendive, Mont. Mr. Pearce was born in 1886 at Ligonier, Ind., and after attending Purdue University, entered railway service with the Northern Pacific in May, 1906. In 1909 he was appointed assistant engineer at Jamestown, N.D., in 1911, being transferred to Duluth, Minn. In 1915 he was promoted to supervisor of bridges and buildings at Glendive, Mont. He held the latter position until 1918, when he was promoted to trainmaster at Forsyth, Mont., and in 1922, he was promoted to general manager of the Walla Walla Valley Ry. Company, a subsidiary of the Northern Pacific. In 1926, he was appointed assistant superintendent, with headquarters at Duluth, Minn., and in 1930, was transferred to St. Paul, Minn.

O. M. Dawson, assistant superintendent in charge of maintenance of way on the Pocahontas division of the Norfolk & Western, has been promoted to superintendent of that division, with headquarters at Bluefield, W. Va. Mr. Dawson was born at Richland, Va., on June 3, 1897, and attended Emory and Henry and Roanoke Colleges. After service in the mechanical department of the Norfolk & Western between terms of school, he became a chainman in the engineering department in 1916, but resigned the following year to enter military service. After the war he returned to the Norfolk & Western as a boilermaker, and in August, 1923, he was appointed assistant roadmaster on the Radford division. In January, 1927, he was promoted to roadmaster on the Shenandoah division, and two years later he was advanced to assistant superintendent of that division. He was later transferred successively to the Radford, Scioto, and Pocahontas divisions.

Engineering

Allen K. Frost, head of the engineering staff in the divisions engineer's office of the Erie at Huntington, Ind., has been promoted to assistant engineer in the chief engineer's office at Cleveland, Ohio.

L. H. Bond, engineer maintenance of way of the Illinois Central, with headquarters at Chicago, has been appointed chief engineer maintenance of way with the same headquarters.

M. M. Backus, assistant engineer maintenance of way of the Illinois Central with headquarters at Chicago, has been appointed assistant chief engineer maintenance of way with the same headquarters.

Fred Evans, assistant engineer on the Philadelphia Terminal division of the Pennsylvania, has been transferred to the Maryland division, with headquarters at Baltimore, Md.

F. G. Smith, whose promotion to division engineer of the Pennsylvania division of the New York Central, with headquarters at Jersey Shore, Pa., was reported in the August issue, was born on October 14, 1885, at Conneautville, Pa., and was educated in civil engineering at Allegheny College. He first entered railway service with the New York Central on May 22, 1909, as a chainman, advancing through the positions of rodman, draftsman and transitman during the next few years. On August 14, 1916, he was promoted to assistant supervisor of track with headquarters at Watertown, N.Y., and on January 15, 1923, he was further promoted to assistant division engineer with headquarters at Jersey Shore. Three years later Mr. Smith was transferred to the main line at Syracuse, N.Y. He was appointed supervisor of track on April 1, 1929, and held this position at various points. Mr. Smith had served as assistant engineer of track at New York since June 16, 1936.

F. G. Smith

Benjamin H. Crosland, roadmaster on the St. Louis-San Francisco, with headquarters at Fort Scott, Kan., has been promoted to division engineer of the Northern division, with the same headquarters, succeeding **Quin Baker,** whose promotion to assistant superintendent is reported elsewhere in these columns. Mr. Crosland was born in Rochester, N.Y., on July 9, 1891, and graduated from Valparaiso University in 1913. Previous to entering college, he served for a short period as a chainman on location and construction work on the Canadian Pacific, and following graduation was employed until 1917 by the Interstate Commerce Commission on railway valuation work. During the war he was commissioned a lieutenant and served with the 70th Engineers on railway construction work. After the war, he returned to valuation work with the I.C.C., but left in 1920 to become a transitman and assistant engineer on the Frisco. In 1926, Mr. Crosland was promoted to roadmaster on the Kansas City terminal, and in 1928 he was advanced to assistant division engineer at Fort Scott. He was appointed roadmaster at that point in 1931.

Benjamin H. Crosland

A. C. Bradley, assistant superintendent on the Chicago, Rock Island & Pacific, with headquarters at Minneapolis, Minn., has been appointed division engineer (including the duties of master carpenter) of the Southern division, with headquarters at Forth Worth, Tex., relieving **H. G. Dennis,** who has been appointed bridge supervisor with headquarters at El Reno, Okla.

A. J. Flanagan, whose promotion to assistant division engineer of the Eastern division of the New York Central, with headquarters at New York, was announced in the August issue, was born

at New York, on January 25, 1895, and received his higher education at New York University. He entered the service of the New York Central as a rodman on December 13, 1916, being advanced to draftsman on October 1, 1917, and thence to transitman on March 1, 1923. Five years later, Mr. Flanagan was promoted to assistant supervisor of track, with headquarters at Beacon, N.Y. On December 16, 1930, he was transferred to the Electric division, being assigned to the west side territory in New York, where he was located at the time of his promotion to assistant division engineer.

Alan T. Danver, whose appointment as chief engineer of the Rutland, with headquarters at Rutland, Vt., was reported in the August issue of *Railway Engineering and Maintenance,* was born on June 21, 1893, at Stamford, Conn. He was graduated from Tufts College Engineering School in 1915. Mr. Danver entered railroad service in July, 1915, with the

Alan T. Danver

Boston & Maine and served until November of that year as an assistant bridge inspector. He then went with the Boston & Albany and served from November 16, 1915, to July 1, 1918, as a structural draftsman; then to April 4, 1924, as a structural designer; and from that date to June 27, 1925, as assistant engineer in charge of construction on the Boston & Albany in connection with the Castleton cut-off project. On June 29, 1925, he entered the service of the Rutland as engineering assistant, and in November, 1927, he was appointed principal assistant engineer, with supervision over engineering and valuation work, which position he held until his recent appointment as chief engineer.

Track

A. F. Wilson, instrumentman on the Kamloops division of the Canadian National, at Kamloops, B.C., has been appointed acting roadmaster on the Clearwater subdivision, succeeding **D. C. Gough,** who has been appointed acting assistant superintendent, with headquarters at Kelowna, B.C., a newly-created, temporary position.

H. C. Cutshall, roadmaster on the New Castle division of the New York, Chicago & St. Louis, with headquarters at Muncie, Ind., has been transferred to Division "A" of the Clover Leaf district with headquarters at Delphos, Ohio, succeeding **W. C. Ruby,** who has retired on account of ill health. **J. C. Hayes,** has been appointed roadmaster at Muncie replacing Mr. Cutshall.

D. W. Bickett, roadmaster on the Chicago, Rock Island & Pacific, with headquarters at Fairbury, Neb., has been transferred to Dalhart, Tex., succeeding **C. M. Webb,** who has been transferred to St. Joseph, Mo., to replace **S. P. Jones.** Mr. Jones has been transferred to Trenton, Mo., to relieve **F. A. Williams** who, in turn, has been transferred to Fairbury to succeed Mr. Bickett.

A. Eremko, section foreman on the Canadian Pacific at Wynyard, Sask., has been promoted to roadmaster, with headquarters at Estevan, Sask., succeeding **J. Bain** who has been transferred to Regina, Sask., replacing **A. Hart,** roadmaster of the Tyvan and Kisbey subdivisions. Mr. Hart has been appointed roadmaster of the Colonsay subdivision, with headquarters as before at Regina, relieving **T. Roulston,** who in turn succeeds **J. C. Jones,** roadmaster with headquarters also at Regina, whose promotion to assistant superintendent at Wynyard, is announced elsewhere in these columns.

Roy A. Williams, whose promotion to roadmaster on the Chicago, Burlington & Quincy with headquarters at Wymore, Neb., was reported in the August issue, was born at Fortescue, Mo., on March 30, 1890, and first entered railway service on September 2, 1905, as a section laborer on the Burlington. On October 1, 1908, he was promoted to section foreman at Rulo, Neb., and on September 16, 1931, he transferred to Dawson, Neb. He was promoted to track supervisor on January 19, 1935, with territory between Napier, Mo., and Pawnee, Neb., and held that position until his recent promotion.

Roy H. Morris, extra gang foreman on the Missouri Pacific at Kansas City, Mo., has been promoted to track supervisor, with headquarters at Scott City, Kan. Mr. Morris was born at Smith Center, Kan., on October 2, 1899, and first entered railway service on July 22, 1922, as a section laborer on the Kansas City Southern. On August 1, 1923, he was promoted to section foreman but resigned in December, 1925, to enter other business. On October 6, 1926, he entered the service of the Missouri Pacific as a section foreman, and on April 1, 1935, he was promoted to extra gang foreman, the position he held at the time of his recent promotion.

F. B. Cherry, extra gang foreman on the Missouri Pacific has been promoted to track supervisor, with headquarters at Scott City, Kan. Mr. Cherry was born at Swayne, Kan., on May 7, 1902, and entered railway service on August 1, 1917, as a section laborer. In November, 1918, he transferred to the bridge and building department and worked successively as a helper, carpenter and assistant foreman. In February, 1924, Mr. Cherry returned to the maintenance of way department as a section laborer and on August 7 of that year was promoted to section foreman at Mapleton, Kan. In January, 1928, he was promoted to extra gang foreman and served as a foreman and an extra gang foreman until his recent promotion to track supervisor.

W. Troy Bloomfield, general track foreman in the Oelwein yard of the Chicago Great Western at Oelwein, Iowa, has been promoted to roadmaster at Clarion, Iowa, succeeding **I. Strom,** who has been assigned to other duties. Mr. Bloomfield was born at Parnell, Mo., on July 5, 1897, and attended Missouri Wesleyan College at Cameron, Mo. He entered railway service on March 12, 1929, as a section laborer on the Great Western at Parnell and in June, 1930, he was promoted to assistant foreman on extra gang work. On March 12, 1931, he was advanced to section foreman and served in that capacity in the Kansas City, Mo., yard and the St. Joseph, Mo., yard. On April 9, 1938, Mr. Bloomfield was promoted to general track foreman in charge of the Oelwein yard.

Maurice R. Black, whose promotion to track supervisor on the Louisville & Nashville at Etowah, Tenn., was announced in the July issue, was born in Barbourville, Ky., on November 22, 1904. He was graduated in civil engineering from the University of Kentucky in 1925, and later received degrees from the John Randolph Neal College of Law, Knoxville, Tenn. He entered railway service in June, 1924, as a rodman on the L. & N., working on double-track construction on the Cumberland Valley division, but resigned that fall to return to school. The following summer Mr. Black returned to the L. & N. as an instrumentman at Knoxville, where he was located at the time of his recent promotion to track supervisor.

Homer L. Woldridge, a member of the engineering staff in the assistant chief engineer's office of the St. Louis-San Francisco at Springfield, Mo., has been promoted to roadmaster, with headquarters at Kansas City, Mo., succeeding **A. J. Finn,** who has been transferred to Fort Scott, Kan., to replace **B. H. Crosland,** whose promotion to division engineer is reported elsewhere in these columns.

Mr. Woldridge was born at Breckenridge, Mo., on April 13, 1903, and attended the University of Missouri. He entered railway service in the engineering department of the Frisco on June 16, 1927, and in February, 1931, he was appointed a welder helper. Two years later he was promoted to welder, and in April, 1935, he was transferred to the office of the assistant chief engineer at Springfield.

J. W. Jones, whose promotion to track supervisor on the St. Louis Terminal division of the Missouri Pacific, with headquarters at Dupo, Ill., was announced in the August issue, was born at Harrisburg, Ark., on November 23, 1897, and entered railway service on the Missouri Pacific as a section laborer on January 22, 1922. He was promoted to extra foreman, serving at various places on the Memphis division from March 20, 1923, until February 1, 1924, when he was advanced to a regular section foreman at

Ferguson, Ark. Mr. Jones was promoted to extra gang foreman on July 1, 1926, and later served as section foreman at Greenfield, Ark., extra gang foreman at various points, and extra roadmaster on the Paragould district and the Memphis district of the Memphis division. He was extra gang foreman on the Memphis division at the time of his recent promotion to track supervisor.

Vernie Larson, assistant roadmaster on the Chicago, St. Paul, Minneapolis & Omaha, at Worthington, Minn., has been promoted to roadmaster at Emerson, Neb., succeeding **E. Iverson,** and **Leo Hogan,** assistant roadmaster at Emerson, has been transferred to Worthington to replace Mr. Larson. **A. F. Trautman,** section foreman at Sioux City, Iowa, has been promoted to assistant roadmaster at Emerson, succeeding Mr. Hogan.

Mr. Larson was born at Laurel, Neb., on September 17, 1896, and entered railway service on June 20, 1912, as a section laborer on the Omaha at Thurston, Neb. During the World War he served in the U.S. Navy and after the war he re-entered the service of the Omaha as a section laborer and a relief foreman. In April, 1931, he was promoted to section foreman at Oakland, Neb., and later served as a section foreman at Mountain Lake, Minn., and at Le Mars, Iowa. In December, 1934, Mr. Larson was advanced to assistant roadmaster at Worthington, Minn., and served in that capacity until his recent promotion.

Bridge and Building

H. G. Dennis, division engineer on the Chicago, Rock Island & Pacific at Fort Worth, Tex., has been appointed bridge supervisor, with headquarters at El Reno, Okla.

N. M. Brown, whose retirement as supervisor of bridges and buildings on the Atlanta division of the Nashville, Chattanooga & St. Louis, with headquarters at Cartersville, Ga., was reported in the August issue, entered railway service in 1886 as a section laborer on the Western & Atlantic (now a part of the Nashville, Chattanooga & St. Louis) and on January 1, 1891, he became a bridge carpenter. He was promoted to bridge foreman on May 1, 1900, and on February 14, 1904, he was advanced to supervisor of bridges and buildings, the position he held at the time of his retirement.

C. F. Montague, master carpenter on the Monongahela division of the Pennsylvania, with headquarters at Pittsburgh, Pa., has been transferred to the Delmarva division, with headquarters at Harrington, Del., to succeed **W. R. Taggart,** who has been transferred to the Atlantic division of the Pennsylvania-Reading Seashore Lines, with headquarters at Camden, N.J. Mr. Taggart succeeds **W. R. Ganser,** who has been transferred to the Long Island (part of the Pennsylvania system), with headquarters at Jamaica, L.I., to fill a position that has been vacant for some time.

Murray Lennox, whose appointment as acting bridge and building master of the Halifax division of the Canadian National, with headquarters at Halifax, N.S., was announced in the August issue, has been appointed bridge and building master of that division. Mr. Lennox commenced his career with Hamilton Bridge Works some 16 years ago when that company was rebuilding bridges on the Halifax and Southwestern branch of the Canadian National, and first entered railway service upon the completion of that work as a carpenter on the Canadian National. He was later promoted to bridge and building foreman and remained in that position until his recent promotion.

William Lee Ratliff, whose retirement as supervisor of bridges and buildings on the Illinois Central, with headquarters at McComb, Miss., was reported in the August issue, first entered railway service on June 1, 1892, as a carpenter on the Louisville, New Orleans & Texas (now a part of the Illinois Central system). On March 20, 1894, he was promoted to bridge and building foreman serving in that capacity and as a relief bridge and building foreman on the New Orleans division and on the Yazoo & Mississippi Valley (part of the Illinois Central System). On January 1, 1908, Mr. Ratliff was promoted to supervisor of bridges and buildings on the Louisiana division and on the Gulf & Ship Island division. He continued in this position until the time of his retirement.

Obituary

Levi B. Lincoln, principal assistant engineer of the Bangor & Aroostook at Houlton, Me., died in that city August 18, following an operation.

F. W. Gilcreast, former consulting engineer of the Lehigh & New England, died on July 16, at his home in Bethlehem, Pa. Mr. Gilcreast was retired on April 1, 1936.

Conway E. Cartwright, who resigned as division engineer of the Canadian Pacific at Vancouver, B.C., in 1910, to enter private engineering practice, died at Vancouver on July 4.

William O. Eggleston, who retired as master carpenter and bridge inspector, on the Erie in 1927, died at Huntington, Ind., on May 13. Mr. Eggleston had had 59 years of continuous railroad service and was 85 years old at the time of his death.

Nelson Edward Gutelius, assistant engineer maintenance of way of the Canadian Pacific, with headquarters at Toronto, Ont., died on July 30 from a heart attack, at his home in that city. He was 54 years old.

J. Bertram Young, engineer of tests of the Reading, with headquarters at Reading, Pa., died on July 29. He first went with the road in 1898 as assistant chemist, was advanced to the position of chemist in 1906 and became engineer of tests in 1920.

Frederick William Hausgen, who until his retirement in 1933 was bridge and building supervisor on the Missouri Pacific, with headquarters at Sedalia, Mo., died at the Missouri Pacific hospital in St. Louis, Mo., on July 2, after several months illness. Mr. Hausgen had been an employe of the Missouri Pacific for 47 years.

Harry Clifford Crowell, assistant engineer on the staff of the chief engineer of the New York zone of the Pennsylvania, with headquarters at New York, died of a stroke on July 29, at his home in Flushing, Long Island, N.Y., after an illness of three weeks duration. He was 55 years old. Mr. Crowell was born on September 4, 1882, in Marblehead, Mass., and attended Massachusetts Institute of Technology, from which institution he was graduated in 1903 with a degree of B.S. in civil engineering. He entered railroad service in June, 1903, as a levelman in the Pennsylvania maintenance of way department at Pittsburgh, Pa. After serving in various capacities at Pittsburgh and Loganport, Pa., he was promoted to assistant to chief engineer at Philadelphia, Pa. In 1929 he was transferred to the New York zone. Among his duties Mr. Crowell represented the Pennsylvania and Long Island railroads in many civic bodies in New York City and co-operated with New York World's Fair 1939, Inc., in railroad matters, as well as the Eastern Presidents' Conference in connection with the railroad exhibit at the Fair.

H. C. Crowell

J. G. Sullivan, who retired as chief engineer of the Western lines of the Canadian Pacific in 1918 and who since that time has been in consulting engineering practice at Winnipeg, Man., died suddenly in that city on August 7 at the age of 75 years. Mr. Sullivan entered the employ of the Canadian Pacific in 1900. From 1905 to 1907 he was assistant chief engineer on the construction of the Panama Canal, returning to the Canadian Pacific in the latter year. He was in charge of the Canadian government's survey for a railroad outlet for the Peace river valley in 1922. Among the notable structures built under his direction was the five-mile Connaught tunnel of the Canadian Pacific, through the Selkirk mountains near Glacier, B.C. Mr. Sullivan was long active in the work of the American Railway Engineering Association, of which organization he was president in 1917-18 and was made an honorary member at the last convention.

Supply Trade News

General

The Edward O'Malley Valve Co., Blue Island, Ill., has purchased the **Central Valve Mfg. Co.,** successor to the O'Malley-Beare Valve Company, and moved its offices to the Central's plant at 231 East Ninety-fifth street, Chicago. Officers of the new company are: President, **Edward O'Malley, Sr.;** vice-president, **Edward O'Malley, Jr.;** secretary **J. G. McNeil;** and general manager, **S. C. Boston.**

Personal

Melvin B. Ericson, at one time associated with the Houdaille-Hershey Corporation, has been elected president of the **Pettibone-Mulliken Corporation,** Chicago.

J. F. Linthicum, executive vice-president of the **American Lumber and Treating Company,** Chicago, has been elected president to succeed **R. M. Morriss,** who has been elected vice-president, in which capacity he will devote his attention to the promotion of treated lumber. **Harold H. Humphreys,** auditor of the company, has been elected secretary, succeeding **Roger L. Foote,** retired.

Mr. Linthicum graduated from St. John's College at Annapolis, Md., in 1902, and during the ensuing eleven years held a number of positions as chemist with eastern industrial and mining companies, including four years in Cuba. He became associated with the Aluminum Company of America in 1913 when he was placed in charge of all mine exploration and development work of the American Bauxite Company at Bauxite, Ark. Four years later, he was transferred to East St. Louis as technical superintendent of the No. 2 Works of the Aluminum Ore Company, another subsidiary of the Aluminum Company of America. During the war, he held a number of civilian appointments, and then returned to the Aluminum Company as a specialty salesman at Cleveland, Ohio. He was transferred to Pittsburgh in 1925. Later he was promoted to division sales manager in charge of ingot, alloy and ore sales, which position he held until September 1, 1937, when he became executive vice-president of the American Lumber & Treating Company, which company he helped to organize in 1934 and of which he had acted as a director. He held the latter position until he was elected president on August 1, 1938. In 1928, he also took an active part in the formation of the National Aluminate Corporation, Chicago, and has been a director of this company for 11 years.

J. F. Linthicum

Obituary

Arthur W. Armstrong, president of the Wood Preserving Corporation, a subsidiary of the Koppers Company, with headquarters at Pittsburgh, Pa., died in St. Lukes Hospital, Chicago, on August 6, of pneumonia. He was born in Evanston, Ill., on April 9, 1885, and first worked in the freight department of the Chicago & North Western in 1903. In 1904 he entered the employ of the Ayer & Lord Tie Company in the general offices. In 1905 he returned to Northwestern University, and upon graduation from that institution in 1907, was appointed superintendent of the Ayer & Lord treating plant at Grenada, Miss. Two years later he was made general auditor at Chicago. In 1915, he was appointed secretary and treasurer, which position he held until 1925, when he was appointed vice-president and general manager. In 1927 he was elected president and general manager. When the Koppers Company acquired an interest in the Ayer & Lord Tie Company, the Century Wood Preserving Company, the National Lumber & Creosoting Company and a number of other companies and formed the Wood Preserving Corporation in July, 1930, Mr. Armstrong became vice-president of that company and a member of its executive committee and in September, 1933, he was made president. At the time of his death, he was also president and a director of the Carolina Wood Preserving Company, the Southern States Mineral Company and the National Lumber & Cresoting Company. Mr. Armstrong has long taken an active part in the promotion of treated timber and has been active in the work of the Service Bureau of the Wood Preservers Association.

Arthur W. Armstrong

Trade Publications

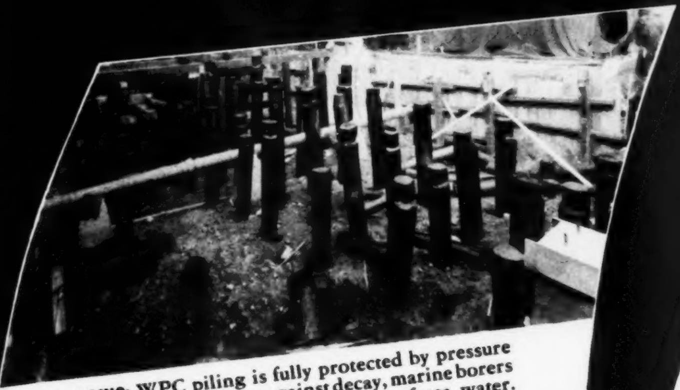
Tapes and Rules.—The Lufkin Rule Company, Saginaw, Mich., has issued a 46-page booklet, 3½ in. by 6 in., bound in cardboard, that comprises a neat and compact catalog of its complete line of tapes, tape-rules and rules. Each item is covered by a small illustration and a description, together with a price list.

Direct-Current Motors—Construction details of the direct-current motors developed by Fairbanks, Morse & Company, Chicago, are described and illustrated in Bulletin 2260. The line of motors, designed to meet a wide range of requirements, comprises ratings up to 200 hp. with mechanical modifications for both high and low voltage operation.

Armco Sewers—The use of Armco paved invert pipe in the construction of sewers is treated in a 48-page, elaborately printed and illustrated booklet published by the Armco Culvert Manufacturers Association, Middletown, Ohio. The booklet starts out with a section on the strength qualifications of Armco pipe and then discusses the qualifications of Armco paved invert pipe for use in the construction of sewers. Other sections are devoted to joints and fittings, cost of pipe sewers, installation data, design and specifications.

Koppers Yearbook, 1938—Products and services supplied to almost every industry in this country by the Koppers Company, Pittsburgh, Pa., are attractively set forth in a 36-page booklet just issued by this company. Essentially an annual report of the company's activities in 1937, the contents are written for the layman, with numerous illustrations. The booklet points out that the largest part of Koppers operations lies in the processing and distributing of coal and coke and in the refining and application of coke oven gas, coal tar, and other derivatives of coal, but that Koppers, through its subsidiaries and affiliates, also distributes tar for road surfacing, roofing, and waterproofing, and creosote for timber preservation (a large share of which is consumed in Koppers wood-treating plants throughout the country); manufactures coal preparing and handling equipment, bronze castings, self-aligning couplings for power transmission, piston rings for the automotive industry, valves and sluice gates for waterworks and sewerage disposal plants; builds and reconditions ocean vessels up to 10,000 tons; and offers engineering services for the design and construction of plants and machinery for industry in general. Following this exposition of the company's range of activities, the results of its operations in 1937 are stated in simple terms, with details of sales, taxes, freight shipments, the addition of new products, employment, and payrolls, followed by brief summaries for each of the operating divisions and subsidiaries. The booklet concludes with a chart of the corporate set-up of the company and a map locating the different plants and other properties owned by the Koppers organization.

IN HOW MANY PLACES BESIDES TRACKS *do you use* PRESSURE-TREATED TIMBER



1. PILING: WPC piling is fully protected by pressure treatment with creosote against decay, marine borers and the destructive chemical action of sea water.

2. CULVERTS: On many installations, this type of culvert, built of WPC pressure-treated timber, has proved more economical than any other kind.

3. POLES AND POSTS: Pressure-treated poles, cross arms and posts give added years of trouble-free service. The Wood Preserving Corporation has complete facilities for framing before treatment.

Thousands upon thousands of miles of track prove the value of pressure-treated timber for cross ties. And railroads, first to realize its advantages and standardize on its use for cross ties, are finding many new ways in which pressure-treated wood can save them money. Adequate stocks maintained by The Wood Preserving Corporation assure prompt shipments to meet exacting requirements.

4. CRIBBING: Cribbing lasts longer when it is built of pressure-treated creosoted timber. Facilities for pre-fabricating are available at all plants of The Wood Preserving Corporation.

5. PIERS, WHARVES: Timber that is alternately wet and dry should be pressure treated with creosote to protect it against decay.

OTHER PRODUCTS AND USES FOR PRESSURE-TREATED TIMBER

6. Station Platforms . . . 7. Trestles . . . 8. Bridges . . . 9. Water Tanks . . . 10. Crossing Planks . . . 11. Cross Arms . . . 12. Car Stock . . . 13. Structural Timber . . . 14. Fences . . . 15. Cooling Towers . . . 16. Third Rail Ties and Guards . . . 17. Flumes . . . 18. Trench Lining and Covers

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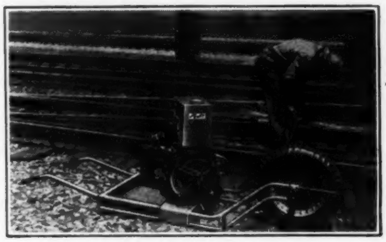
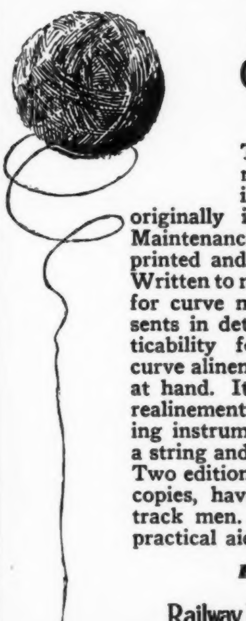
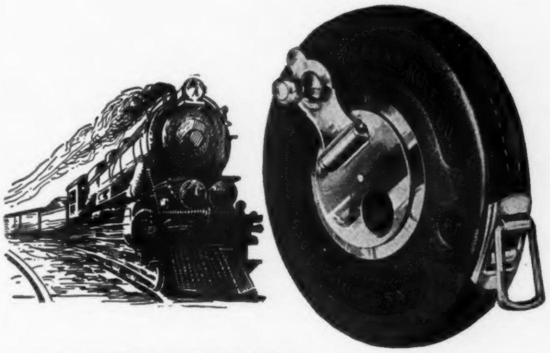
THE WOOD PRESERVING CORPORATION

PITTSBURGH, PA.

a **K O P P E R S** *subsidiary*







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